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ANNUAL RESEARCH PROGRESS REPORT

1 JULY 1976

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UNITED STATES ARMY INSTITUTE OF DENTAL RESEARCH
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, D.C., 20012

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ANNUAL REPORT	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) (6) Annual Research Progress Report FY 1976.	5. TYPE OF REPORT & PERIOD COVERED Rept. for Annual 1 Jul 75 - 30 Jun 76.	6. PERFORMING ORG. REPORT NUMBER
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9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Institute of Dental Research Washington, D.C. 20012	10. PROGRAM ELEMENT, PROJECT, TASK AND REPORT NUMBER (16) 3A161101A91C Task 00 3A161102B71R Task 04 3A162110A825 Task 00	
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18. SUPPLEMENTARY NOTES None		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Alumina Implants, Analgesia, Analgesics, Bacterial Contamination, Bacterial Identification, Base Metal Alloys, Biodegradable Ceramic, Biodegradable Polymers, Bone Healing, Casting Accuracy, Cavitron Instrumentation, Cemented Cast Restorations, Cervical Erosion, Chelation, Cold Sterilization, Combat Wounds, Compression Devices, Contaminated Dental Units, Crown and Bridge Alloys. (Cont'd on reverse)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) DA Project 3A161101A91C In-House Laboratory Independent Research - This program is instituted as one aspect of a broad approach to provide individual Army scientists and engineers an additional opportunity to maintain and increase their competence by doing original work in areas suiting their talents, thereby promoting a vigorous internal research program of the highest technical caliber. (Cont'd on reverse)		

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(Continuation of Block 19) Cyclic AMP, Cysteamine-N-Acetic Acid, Debridement, Dental Casting, Dental Education, Dental Floss, Dental History, Dental Instruments, Dental Material Toxicity, Dental Records, Dental Therapy, Dental Treatment, Dento-facial Injuries; Denture Fabrication, 2,3, Dimercaptopropane Sodium Sulfonate, Dry Heat Sterilizers, Electric Current, Electroanesthesia, Electroless Plating, Endodontic Instruments, Endodontic Materials, Fillers, Fixed Dental Restorations, Flossing Device, Forensic Dentistry, Fractured Anterior Teeth, Fracture Fixation, Gingival Healing, Glazed Enamel, Granulomatous Tissue, Gutta Percha, Hand Lipids, High Fusing Alloys, Hot Stage Microscopy, Labial Frenum, Laser Welding, Lipids, Liquid Chromatography, Maxillary Ameloblastoma, Maxillo-facial Combat Wounds, Medical History, Mercury, Mercury Detoxification, Mercury Vapor, Nitinol, Nitrous Oxide, Occlusal Restorations, Occupational Hearing Loss, Occupational Stress, Oral Antral Fistula, Oral-facial Fractures, Oral Health Evaluation, Oral Hygiene, Oral Prophylaxis, Osteogenesis, Patient Questionnaires, Pit and Fissure Caries, Plaque pH, Plaque Prevention, Polaroid Pictures, Polyglycolic Acid, Polylactic Acid, Polymers, Porcelain-Base-Metal, Porcelain-Fused-To-Metal, Predentin Index, Pulpal Injury, Pulp Tester, Pulse Pressure Lavage, Preventive Dentistry, Psychosomatic Disorders, Regional Block, Sealants, Sedation, Silver Cones, Stress in Dentistry, Surgical Bur, Surgical Laser, Surgical Scrub, Temperomandibular Joint, Toothbrush Effectiveness, Transient Bacteremia, Tricalcium Phosphate, Tricalcium Phosphate Ceramic, Ultrasonic Scaling, UV Light, Valium, Water Lavage, Wound Debridement, Wound Healing, Wound Sterilization.

(Continuation of Block 20)

Task 00

DA Project 3A161102B71K Research in Biomedical Sciences - The objectives are to obtain information by the techniques of clinical and basic research on injuries and diseases, except communicable diseases, commonly seen in soldiers, especially in field operations and overseas. The work is divided according to the major medical specialties. Emphasis is placed on diseases and injuries which are receiving little or no study by civilian research groups, and the work is aimed at providing better preventive measures as well as treatment.

Task 04 Dentistry

Division of Basic Sciences

Division of Preventive Dentistry

DA Project 3A162110A825 Oral and Maxillofacial Sciences - The objectives are to develop simplified procedures for the care of complex maxillofacial wounds and injuries which require long time-consuming procedures for reconstruction, to achieve minimal morbidity rates from oral emergencies, preventable oral disease, and restorative failures. To develop more efficient, simplified, effective clinical and laboratory techniques which will result in better utilization of manpower and a saving in time and materiel.

Task 00

Division of Oral Pathology

Division of Surgery

Division of Dental Materials

Division of Clinical Research

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Reports Control Symbol MEDDH-288 (R1)

US ARMY INSTITUTE OF DENTAL RESEARCH
WALTER REED ARMY MEDICAL CENTER
Washington, D.C. 20012

ACCESSION for	
NTIS	White Section <input checked="" type="checkbox"/>
B&C	Buff Section <input type="checkbox"/>
UNANNOUNCED	<input type="checkbox"/>
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODES	
Dist.	Avail. and/or SPECIAL
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ANNUAL RESEARCH PROGRESS REPORT
1 July 1975 - 30 June 1976

(The 7T period will be included in the FY 77 Annual Progress Report)

DA Project 3A161101A91C	Task 00	<u>In-House Laboratory Independent Research</u>
DA Project 3A161102B71R	Task 04	<u>Research in Biomedical Sciences - Dentistry</u>
DA Project 3A162110A825	Task 00	<u>Oral and Maxillofacial Sciences</u>

FOREWORD

During FY 76 the US Army Institute of Dental Research has continued to emphasize and successfully accomplish research resulting in the development and application of hardware, materials and methods which will directly improve the delivery of oral health care as it relates to the soldiers ability to perform his military mission. Advances also continue in the acquisition of fundamental knowledge which will lead ultimately to the continued improvement of military dentistry.

Significant accomplishments continue in the application of methodology requiring the development of new hardware. These include:

1. A highly successful test of the surgical arm and hand washer developed by USAIDR. Under actual hospital use conditions the prototype instrument demonstrated the vast improvement this method brings to pre and post surgical scrubbing.
2. The successful application of prototype electroanesthesia equipment to primates during several kinds of oral surgical procedures. Special advantages over drug anesthesia were demonstrable.
3. A prototype instrument for a new and improved method of pulp vitality testing is in the clinical testing stage and continues to be promising.

The continuing development of other methods and related materials have also resulted in a number of significant accomplishments. Some of these are as follows:

1. The application of tricalcium phosphate as a means of reversing alveolar bone disease. Two year clinical testing in humans has thus far produced positive results.

2. Continued demonstration of the high potential of electroless plating as a rapid and effective reversible means of providing caries prevention to large numbers of soldiers.

3. The successful submergence of endodontically treated roots in humans as a means of maintaining the alveolar ridge and thus stabilizing prosthetic appliances.

4. The use of copolymers for resolving oral antral fistulae, producing hollow organ grafts and providing in-vivo, long-term, slow drug release.

5. A new method for significantly increasing the bond strength of porcelain fused to base metals in prosthetic appliances. This process will significantly reduce the failure rate of such appliances.

6. A new mercury detoxifying agent which is far superior to any presently available.

7. An improved method for the cold sterilization of dental instruments which will insure sterility without damage to the instruments.

8. The application of laser welding to the repair of prosthetic appliances not repairable by any other means. This promises huge savings.

9. The laser welding of tricalcium phosphate to alumina tooth implants as a means of improving the tissue acceptability of such implants.

USAIDR PROJECTS, TASKS, AND WORK UNITS

(Responsible Division in Parentheses)

3A161101A91C	IN-HOUSE LABORATORY INDEPENDENT RESEARCH	<u>Page No.</u>
00	In-House Laboratory Independent Research	
DA OF 6045	An Evaluation of Using Intraoral Polaroid Pictures as a Means of Recording Dental Treatments and Identifying Soldiers in Mass Casualty Situations (Preventive Dentistry)	1
DA OF 6046	Special Surgical Bur for Precision Debridement of Soft Tissue in Facial Combat Wounds (Division of Basic Sciences)	2
DA OF 6047	Evaluation of Mechanical Dental Flossing Device as Compared to Hand-Held Floss (Preventive Dentistry)	3
DA OF 6048	A Determination of the Time Requirements for Placement of a Sealant Compound Versus Conventional Treatment (Preventive Dentistry)	4
DA OG 6021	Drugs for the Detoxification of Mercury Taken in by Dental Personnel (Basic Sciences)	5
DA OG 6024	An Evaluation of the Adequacy of the Dental Medical History (Pathology)	6
DA OG 6030	Utilization of the Surgical Laser in Maxillo-facial Wounds (Pathology)	7
DA OG 6031	A Rapid Method for the Identification of Pathogenic Bacteria Associated with Combat Wounds (Basic Sciences)	8
DA OG 6035	Hot Stage Microscopy of High Fusing Alloys (Dental Materials)	9
DA OG 6036	The Effect of Chelating Agents in Stabilizing Electroless Plating Systems (Basic Sciences)	10
DA OG 6037	An Evaluation of the Effects of Cavitron Instrumentation on the Retention of Cemented Cast Restorations (Dental Materials)	11

3A161102B71R	RESEARCH IN BIOMEDICAL SCIENCES	
04	Dentistry	<u>Page No.</u>
DA OB 6037	Acceleration of Wound Healing (Basic Sciences)	12
DA OD 6021	The Problems Involved in Military Oral Health Care Delivery Related to Thera- peutic Agents and Materials (Basic Sciences)	13
DA OE 6037	The Use of Electric Currents as an Anesthe- tic Agent (Dental Materials)	14
DA OF 6024	Identification and Control of Oro-facial Infections of Military Importance (Basic Sciences)	15
DA OF 6034	The Identification of Factors Predisposing to Treatment Acceptance by the Soldier Patient (Clinical Sciences)	16
3A162110A825	ORAL AND MAXILLOFACIAL SCIENCES	
00	Oral and Maxillofacial Sciences	
DA OD 6048	Development and Evaluation of Nitinol for Use in Army Dentistry (Dental Materials)	17
DA OE 6022	Preventive Dentistry Measures of Military Significance (Preventive Dentistry)	18
DA OF 6040	Application of Laser Technology to Maxillo- facial Wound Debridement and Prosthetic Rehabilitations (Pathology)	19
DA OG 6033	Development and Evaluation of Dental Materials and Materiel for Army Use (Dental Materials)	20
DA OG 6034	Development and Improvement of Metallic Re- storative Materials (Dental Materials)	21
DA OH 6030	Natural History of Oral Lesions Encountered in the Soldier (Pathology)	22
DA OH 6036	Role of Pressurized Water Lavage in the Prac- tice of Military Dentistry (Basic Sciences)	23
DA OH 6037	New and Improved Techniques for Grafts and Bone Regeneration in Traumatic Wounds (Surgery)	24
DA OH 6038	Development of Endodontic Procedures for Military Dentistry (Basic Sciences)	25

DA OK 6020

Biodegradable Materials for the Treatment
of Fractures and Soft Tissue Wounds in the
Military Situation (Surgery)

Page No.

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL	
				DA OF 6045	76 07 01	DD-DR&E(AR)636	
3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8a. DISSEM INSTR ^a	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
75 07 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES ^a		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
a. PRIMARY		61101A		3A161101A91C		00	
b. CONTRIBUTING						351	
c. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a (U) An Evaluation of Using Intraoral Polaroid Pictures as a Means of Recording Dental Treatment and Identifying Soldiers in Mass Casualty Situations							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a							
003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
74 01		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE: NA				PRECEDING		b. FUNDS (In thousands)	
b. NUMBER: ^a				FISCAL		76	
c. TYPE:				CURRENT		0.2	
d. AMOUNT:				YEAR		0.5	
e. KIND OF AWARD:				77		1	
f. CUM. AMT.							
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: ^a US Army Institute of Dental Research				NAME: ^a US Army Institute of Dental Research			
ADDRESS: ^a Washington, D.C. 20012				Division of Preventive Dentistry			
				ADDRESS: ^a Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: ^a Katz, R., MAJ, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 301-677-7451			
				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
21. GENERAL USE				ASSOCIATE INVESTIGATORS			
Foreign Intelligence Considered				NAME:			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Polaroid Pictures; (U) Dental Records; (U) Dental Treatment; (U) Forensic Dentistry							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To determine the accuracy of intraoral polaroid pictures in forensic dentistry and their accuracy and efficiency as a permanent record of dental treatment provided in the military. An effective system based on polaroid pictures would result in savings in professional man-hours and the cost of maintaining dental records.							
24. (U) In Phase I of this study a total of 200 recruits will be subjected to panorgraphs and intraoral polaroids initially and on recall in one month. Blind comparisons of initial and recall pictures will be made and panorgraphs will be used as controls. In a second phase 100 patients requiring dental treatment will receive intraoral polaroid pictures during and after treatment. Comparison of the written dental records with the polaroid pictures will be used to determine the effectiveness of the polaroids in providing an accurate treatment record.							
25. (U) 75 07 - 76 06) Final results of Part I of this study indicated that the antemortem and post-mortem intraoral photographs were significantly easier to match than the antemortem and post-mortem radiographs ($p < .05$). When the number of patients outnumbered the number of records, there was no significant difference in the examiners ability to identify patients using radiographs and photographs. When the quantity of records outnumber the patients, it was significantly easier to identify patients using intraoral photographs than when panorgraphic radiographs were used ($p < .05$). The results indicate that intraoral photographs might be a good adjunct for use as a forensic dentistry aid in the Army. Part II of this study is continuing.							

^aAvailable to contractors upon originator's approval.

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1 MAR 68

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL	
				DA OF 6046	76 07 01	DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISSEM INSTR*	8b. SPECIFIC DATA- CONTRACTOR ACCESS	9. LEVEL OF SUM
76 03 17	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES*		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
a. PRIMARY		61101A		3A161101A91C		00	
b. CONTRIBUTING						353	
c. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code)* (U) Special Surgical Bur for Precision Debridement of Soft Tissue in Facial Combat Wounds.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS*							
010300 Miscellaneous Materials							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
76 02		76 11 30		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (In thousands)	
b. NUMBER* NA				FISCAL		76	
c. TYPE:				YEAR		77	
d. KIND OF AWARD:				77		0.2	
e. CUM. AMT.						2	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME*US Army Institute of Dental Research				NAME*US Army Institute of Dental Research			
ADDRESS* Washington, D.C. 20012				Division of Basic Sciences			
				ADDRESS* Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME* Paquette, O., LTC, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 301-677-7306			
				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
21. GENERAL USE				ASSOCIATE INVESTIGATORS			
				NAME:			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Surgical Bur; (U) Debridement; (U) Combat Wounds; (U) Granulomatous Tissue.							
23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To design and fabricate prototype plastic rotary instruments to be used for debridement of avulsive type wounds, jaw fractures and extraction sites in the care of combat casualties. The design will allow removal of unwanted granulation tissue, necrotic tissue and cystic tissue without gross alteration of surrounding normal bone. It will therefore increase the speed and efficiency of surgical and periodontal procedures, decrease healing time, and will constitute a cost effective procedure by returning soldiers to duty more rapidly.</p> <p>24. (U) Rotary instruments will be designed, fabricated and perfected at USAIDR.</p> <p>25. (U) 76 03 - 76 06) Two designs have been proposed and made in pilot form. One design is intended to remove soft tissue adherent to bone without damage to the bone, the other, to remove free-standing, unsupported tissue. Both burs are made principally of Kel-F plastic, and have shown promise in laboratory tests using liver tissue. Both designs are intended to remove loose non-vital disorganized tissue, rather than cut, so that adjacent, vital tissues are left unaffected. Because minute amounts of the bur material could conceivably lodge in the tissue in use, it has been deemed advisable to investigate tissue compatibility of minute particles of Kel-F plastic. When suitability of this plastic, or another if necessary, has been confirmed, actual clinical testing will be begun. Work continues.</p>							

*Available to contractors upon originator's approval

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL DD-1 R&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8. DISSEM INSTR ^a	9. SPECIFIC DATA ^a CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
75 11 07	D. CHANGE	U	U	NA	NL		
10. NO./CODES ^a	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	61101A	3A161101A91C		00		354	
b. CONTRIBUTING							
c. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a (U) Evaluation of a Mechanical Dental Flossing Device as Compared to Hand-Held Floss.							
12. SCIENTIFIC AND TECHNOLOGICAL AREA ^a 003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
75 11 07		77 01		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE: NA EXPIRATION:				PRECEDING		b. FUNDS (in thousands)	
b. NUMBER:				FISCAL YEAR		c. FUNDS (in thousands)	
c. TYPE:				CURRENT		1	
d. AMOUNT:				76		0.2	
e. CUM. AMT.				77		0.2	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Preventive Dentistry			
ADDRESS: Washington, D.C. 20012				ADDRESS: Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Katz, R., MAJ, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 301-677-7451			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Barton, R.F., COL, DC			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Dental Floss; (U) Flossing Device; (U) Oral Hygiene; (U) Preventive Dentistry.							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To determine if a dental flossing device (E-Z-denta-flosser [®]) has any advantages over hand-held floss that can be used in aggressive oral health program. It is imperative that more efficient means of teaching, controlling and preventing dental disease among soldiers be developed. A mechanical flossing aid which will improve the self-application of preventive dentistry measures among soldiers would result in reduced expenditures of funds required to treat dental diseases occurring among troops as well as reduce professional man-hours expended in treatment of troops.							
24. (U) Military dental patients will use both hand-held floss and the flossing device for a period of two weeks. Controls will not use floss. Oral hygiene will be evaluated before and after the two week period in all patients using the interproximal sulcular gingival bleeding index. Patient preference for either method of flossing will be evaluated by questionnaire.							
25. (U) (75 11 - 76 06) Study is new. No progress to report.							

^aAvailable to contractors upon originator's approval.

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75 10 31	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES ^a	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
A. PRIMARY	61101A	3A161101A91C	00	355			
B. CONTRIBUTING							
C. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a (U) A Determination of the Time Requirements for Placement of a Sealant Compound versus Conventional Treatment.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a 003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
75 10 31		77 01		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE: NA				PRECEDING		B. FUNDS (in thousands)	
B. NUMBER: ^a				FISCAL		0.2	
C. TYPE:				YEAR		0.5	
D. AMOUNT:				CURRENT		0.5	
E. CUM. AMT.				77		1	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: ^a US Army Institute of Dental Research				NAME: ^a US Army Institute of Dental Research			
ADDRESS: ^a Washington, D.C. 20012				Division of Preventive Dentistry			
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RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: ^a Barnes, G.P., COL, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 301-677-7451			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
				ASSOCIATE INVESTIGATORS			
				NAME: Ziesmer, Dale, LTC, DC			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Sealants; (U) UV Light; (U) Occlusal Restorations; (U) Fractured Anterior Teeth; (U) Fillers.							
23. TECHNICAL OBJECTIVE. ^a 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To compare the treatment time required to restore fractured anterior teeth and the occlusal surfaces of permanent first molars using UV light cured filler and sealant with the treatment time required to perform the same procedures using conventional methods. While several reports have been published evaluating and recommending the use of fillers and sealants, data on the time required for performing filler and sealant procedures are lacking. Before this preventive procedure can be recommended for adoption by the Army it must be compared for cost effectiveness against presently used methods.</p> <p>24. (U) Military dentists will perform restoration procedures using both filler and sealants and conventional methods on a statistically valid number of patients. Treatment times will be recorded. All treatments will be reexamined one month following performance by an independent examiner to determine if restorations are satisfactory.</p> <p>25. (U) (76 10 - 76 06) This study is in progress. Data collection has not yet been sufficient to draw any conclusions.</p>							

^a Available to contractors upon originator's approval.

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PII Redacted

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMRY ^a	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8A. DISSEM INSTN ^a	8B. SPECIFIC DATA- CONTRACTOR ACCESS ^a	9. LEVEL OF SUM ^a
75 07 10	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES ^a	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER	WORK UNIT NUMBER		
A. PRIMARY	61101A	3A161101A91C		00	356		
B. CONTRIBUTING							
C. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a (U) Drugs for the Detoxification of Mercury taken in by Dental Personnel.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a 012600 Pharmacology							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
75 07 10		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:		EXPIRATION:		PRECEDING		FUND (in thousands)	
B. NUMBER: NA				FISCAL 76		0.2	
C. TYPE:		D. AMOUNT:		CURRENT 77		1.5	
E. KIND OF AWARD:		F. CUM. AMT.		77		0.5	
20. RESPONSIBLE DOD ORGANIZATION				21. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Basic Sciences			
				ADDRESS: Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Battistone, G.C., Ph.D.			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-2987			
				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
22. GENERAL USE				ASSOCIATE INVESTIGATORS			
Foreign Intelligence Considered				NAME: Miller, R.A.			
				NAME:			
23. KEYWORDS (Precede EACH with Security Classification Code) (U) Mercury Detoxification; (U) 2,3 Dimercaptopropane Sodium-Sulfonate; (U) Cysteamine-N-Acetic Acid; (U) Mercury Vapor.							
24. TECHNICAL OBJECTIVE, 25. APPROACH, 26. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To develop a drug of greater effectiveness, lower toxicity and broader application for the detoxification of mercury in military dental personnel. Presently available drugs are either effective only in acute toxicity situations or have toxic side effects. Since available data indicate that military dental personnel carry above normal levels of body mercury and the possible subclinical effects of metallic mercury are unknown it would be desirable to have a drug which could be routinely and safely administered for depleting above normal but not clinically toxic levels of mercury in dental personnel.</p> <p>24. (U) Two promising drugs will be evaluated for their ability to deplete body mercury in small animals subjected to the inhalation of known amounts of mercury vapor. If effective these drugs will be evaluated for their toxicity and studies will be extended to primates.</p> <p>25. (U) (75 07 - 76 06) Continued evaluation of 2,3, dimercaptopropane sodium sulfonate (DMPS) in experimental animals indicates that it is far superior to any drug in use or proposed for mercury detoxification. A three day course of 30 mg/kg/day of DMPS removed up to 76% of body mercury in rats. Comparison with N-acetyl penicillamine, at present the most effective experimental mercury detoxifying agent, reveals that DMPS is at least 8 times more effective. No apparent toxic effects have been noted thus far with DMPS administration to small animals. Experiments are now in progress to determine the effect of DMPS on the excretion of essential trace metals and to determine the possible effectiveness of DMPS administration as a better means than currently available of evaluating the body burden of mercury in exposed individuals.</p>							

^a Available to contractors upon originator's approval.

DD FORM 1498
1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 68 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8. DISSEM INSTR ^a	9. SPECIFIC DATA- CONTRACTOR ACCESS	10. LEVEL OF SUM A. WORK UNIT
76 03 19	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES: ^a		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
a. PRIMARY		61101A		3A161101A91C		00	
b. CONTRIBUTING						358	
c. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a							
(U) An Evaluation of the Adequacy of the Dental-Medical History							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a							
003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD ^a	
76 03 19		77 01		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (in thousands)	
b. NUMBER: ^a NA				FISCAL YEAR		c. FUNDS (in thousands)	
c. TYPE:				76		0.2	
d. AMOUNT:				77		0.5	
e. KIND OF AWARD:				77		0.5	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: ^a US Army Institute of Dental Research				NAME: ^a US Army Institute of Dental Research			
ADDRESS: ^a Washington, D.C. 20012				Division of Pathology			
				ADDRESS: ^a Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: ^a Payne, T.F., MAJ, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3258			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
(U) Dental History; (U) Medical History; (U) Dental Therapy; (U) Patient Questionnaires				NAME: Krakow, M.A., MAJ, DC			
				NAME: Lewis, D.M., MAJ, DC			
22. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To determine the adequacy and accuracy of individual medical histories obtained in Army dental clinics by comparing them with the patients medical record. The current practice in dental clinics of obtaining medical histories by patient questionnaires could lead to therapeutic error, duplication of effort, delayed treatment, increased costs and increased professional man-hours in patient care. The results of this study will point to any needed improvements in the present system.							
24. (U) Six hundred randomly selected Army dental records will be examined. Information from the corresponding medical history will be compared with the medical information on the dental record. Discrepancies will be tabulated and analyzed.							
25. (U) 76 03 - 76 06) Due to administrative problems this study is just beginning. No progress to report.							

PII Redacted

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 68 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8a. DISSEM INSTR ^a	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
76 04 15	D. CHANGE	II	II	NA	NT	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES: ^a	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	61101A	3A161101A91C		00		360	
b. CONTRIBUTING							
c. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a							
(U) Utilization of the Surgical Laser in Maxillofacial Wounds.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a							
003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
76 05		77 05		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING			
b. NUMBER: ^a NA				FISCAL		76	
c. TYPE:				CURRENT		77	
d. KIND OF AWARD:				77		0.5	
e. CUM. AMT.						2	
19. RESPONSIBLE OOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: ^a US Army Institute of Dental Research				NAME: ^a US Army Institute of Dental Research			
ADDRESS: ^a Washington, D.C. 20012				ADDRESS: ^a Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: ^a Adrian, J.C., COL, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3258			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME:			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Surgical Laser; (U) Maxillofacial Combat Wounds; (U) Wound Sterilization; (U) Wound Debridement.							
23. TECHNICAL OBJECTIVE, ^a 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To evaluate the CO₂ surgical laser for use in the management of oral-facial combat wounds. Available data indicate that 10-12% of combat wounds and 7% of non-combat wounds requiring hospital care involve the maxillofacial region. The successful application of the CO₂ surgical laser to microsurgery in the aerodigestive system has demonstrated a number of highly desirable characteristics relative to maxillofacial surgery. These include Hemostasis, no postoperative edema, minimal postoperative scarring, sterilization of infected wounds, minimal pain and a sharply demarcated operative field. This suggests that the CO₂ laser may provide a rapid, safe and superior approach to the debridement and subsequent reconstruction of maxillofacial wounds. A more effective modality of managing maxillofacial wounds would result in significant savings in hospital costs and professional man-hours and effect a rapid return of the soldier to duty.</p> <p>24. (U) A CO₂ surgical laser will be utilized to establish base line reactions in normal oral tissues of experimental animals. Subsequently, simulated maxillofacial wounds (to include teeth, bone and soft tissue) will be treated with the surgical laser.</p> <p>25. (U) 76 04 - 76 06) New study; no progress. Needed equipment is on order.</p>							

^aAvailable to contractors upon originator's approval.

DD FORM 1498
1 MAR 68

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PII Redacted

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL	
				DA OG 6031	76 07 01	DD-DR&S(AR)436	
3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8. DESPN INSTR ^a	9. SPECIFIC DATA - CONTRACTOR ACCESS	10. LEVEL OF SUM
76 04 15	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES: ^a		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
a. PRIMARY		61101A		3A161101A91C		00	
b. CONTRIBUTING						361	
c. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a (U) A Rapid Method for the Identification of Pathogenic Bacteria Associated with Combat Wounds.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a							
003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
76 05		77 05		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PREEXISTING			
b. NUMBER: ^a NA				FISCAL YEAR		76 0.2 3.1	
c. TYPE:				CURRENT		77 1.5	
d. KIND OF AWARD:				f. CUM. AMT.		77 0.2 2	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: ^a US Army Institute of Dental Research				NAME: ^a US Army Institute of Dental Research			
ADDRESS: ^a Washington, D.C. 20012				Division of Basic Sciences			
				ADDRESS: ^a Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: ^a Gross, A., COL, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3764			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
				ASSOCIATE INVESTIGATORS			
				NAME: Setterstrom, J., Ph.D.			
				NAME: Iordt, H., Ph.D.			
22. KEYWORDS (Precede EACH with Security Classification Code) ^a (U) Combat Wounds; (U) Bacterial Identification; (U) Liquid Chromatography; (U) Lipids.							
23. TECHNICAL OBJECTIVE, ^a 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To develop an improved, rapid, sensitive and precise method for the identification of Pathogenic bacteria associated with combat wounds. A critical phase in the successful treatment of combat wounds is the early detection and identification of potentially destructive pathogenic organisms and the institution of appropriate therapy. Instrumental techniques are now available which may make it possible to identify unique constituents from different microbial genera thus offering the possibility of rapid and accurate identification of pathogenic organisms directly from body fluids and wounds. Such a procedure could eliminate lengthy and sometimes difficult culturing procedures, reduce man-hours expended in the laboratory, reduce professional man-hours in patient treatment, speed wound healing, lower morbidity and be a positive moral factor for the combat soldier.</p> <p>24. (U) Currently used gas chromatographic methods as well as highly sensitive liquid chromatography methodology recently developed at USAIDR, will be used to identify cellular fatty acids and metabolic by-products produced by wound infecting micro-organism.</p> <p>25. (U) (76 04 - 76 06) New study; no progress.</p>							

^a Available to contractors upon originator's approval.

DD FORM 1498
1 MAR 66

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 66 AND 1498-1, 1 MAR 66 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL	
				DA OG 6035	76 07 01	DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8a. DISSEM INSTR ^a	8b. SPECIFIC DATA- CONTRACTOR ACCESS	9. LEVEL OF SUM A. WORK UNIT
76 04 15	K. COMP	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES: ^a		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
		61101A		3A161101A91C		00	
a. PRIMARY						363	
b. CONTRIBUTING							
c. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a							
(U) Hot Stage Microscopy of High Fusing Alloys							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a							
009900 Metallurgy and Metallography							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
76 04		77 05		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (In thousands)	
b. NUMBER: ^a NA				76		0.1	
c. TYPE:				FISCAL YEAR		1.9	
d. AMOUNT:				CURRENT			
e. KIND OF AWARD:				f. CUM. AMT.			
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: ^a US Army Institute of Dental Research				NAME: ^a US Army Institute of Dental Research			
ADDRESS: ^a Washington, D.C. 20012				Division of Dental Materials			
				ADDRESS: ^a Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: ^a Huget, E.F., LTC, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3092			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: de Simon, L.B.			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) High-Fusing Alloys; (U) Porcelain-Fused-to-Metal; (U) Fixed Dental Restorations; (U) Hot Stage Microscopy.							
23. TECHNICAL OBJECTIVE, ^a 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To study the structural changes that occur in high-fusing alloys during the application of dental porcelain. Of the more than 100,000 fixed dental restorations produced by Army dental laboratories each year, more than one-third involve porcelain-fused-to-metal restorations which are quite prone to failure and subsequent costly re-makes. The goal of this investigation is to clarify and refine production procedures so that initial production costs and failure rates will be significantly reduced.</p> <p>24. (U) Casting alloys of known composition prepared by conventional techniques will be studied at 100° F intervals from room temperature to 2000° F using hot stage microscopy in conjunction with high temperature photography. Microstructural high temperature changes under controlled conditions can then be correlated with established vapor pressures of the test alloy components.</p> <p>25. (U) (76 04 - 76 06) Changes in the surface structure of four gold-palladium-silver based alloys (Cameo, Vivostar, Ney SMG-W and Ceramco White) and a silver-palladium based material (Cameo-Lite) that occur during the application of dental porcelain were studied. It was found that temperatures employed in the "degassing" phase of the process produce marked thermal etching of the substrate (alloy) surface. This facilitates the mechanical attachment of fused porcelain. Therefore mechanical manipulation (grinding, burnishing, etc.) after "degassing" is not recommended.</p>							

^aAvailable to contractors upon originator's approval.

DD FORM 1498
1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 68 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL	
				DA OG 6036	76 07 01	DD-DR&E(AR)636	
3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8a. DESGN INSTR ^a	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
76 04 15	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES ^a	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER	WORK UNIT NUMBER		
a. PRIMARY	61101A	3A61101A91C		00	364		
b. CONTRIBUTING							
c. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a							
(U) The Effect of Chelating Agents in Stabilizing Electroless Plating Systems							
12. SCIENTIFIC AND TECHNOLOGICAL AREA ^a							
010300 Miscellaneous Materials							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
76 05		77 05		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (\$ thousands)	
b. NUMBER: NA				FISCAL YEAR		76 0.1 1	
c. TYPE:				CURRENT		77 0.2 2	
d. KIND OF AWARD:				f. CUM. AMT.			
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				ADDRESS: Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic institution)			
NAME: Cutright, D.E., COL, DC				NAME: Battistone, G.C., Ph.D.			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-2987			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
22. KEYWORDS (Precede EACH with Security Classification Code)				NAME:			
(U) Electroless Plating; (U) Chelation; (U) Pit and Fissure Caries; (U) Sealant.				NAME:			
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To increase the effectiveness of electroless plating as a means of preventing pit and fissure caries. Current research has indicated the feasibility of using electroless plating for this purpose. Present systems however are limited by problems in the solubility and stability of the metal salts which make up these systems. Chelating agents may offer an approach to solving these problems and the possibility of developing new and improved electroless plating systems.</p> <p>24. (U) Presently developed electroless plating systems will be prepared with and without various concentrations of different chelating agents and the resulting preparations will be compared for stability and effectiveness in forming an adherent seal on the tooth surface. Attempts will be made to solubilize and stabilize new heterogenous systems of metals using chelating agents and to effectively plate these systems on teeth.</p> <p>25. (U) (76 04 - 76 06) Thus far this study has established the concept that chelating agents can be used to improve electroless plating systems. The addition of cysteamine-N-acetic acid to an unstable AgNO₃ plating solution has rendered it stable for at least several weeks without interfering with the ability of the solution to form an electroless plate on teeth. The study of other plating systems and chelating agents is in progress.</p>							

^aAvailable to contractors upon originator's approval.

DD FORM 1498
1 MAR 66

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 68 AND 1498-1, 1 MAR 66 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL	
				DA OG 6037	76 07 01	DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8A. DISSEM INSTR ^a	8B. SPECIFIC DATA- CONTRACTOR ACCESS	9. LEVEL OF SUM A. WORK UNIT
76 02 15	K. COMP	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES: ^a		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
		61101A		3A161101A91C		00	
a. PRIMARY						WORK UNIT NUMBER	
						357	
b. CONTRIBUTING							
c. CONTRIBUTING							
11. TITLE (Precede with Security Classification Code) ^a (U) An Evaluation of the Effects of Cavitron Instrumentation on the Retention of Cemented Cast Restorations.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a							
003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
76 02 15		76 07 01		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING			
b. NUMBER: ^a NA				FISCAL YEAR		76	
c. TYPE:				CURRENT		0.1	
d. KIND OF AWARD:						1	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: ^a US Army Institute of Dental Research				NAME: ^a US Army Institute of Dental Research			
ADDRESS: ^a Washington, D.C. 20012				Division of Dental Materials			
				ADDRESS: ^a Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: ^a Huget, E.F., LTC, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3092			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
				ASSOCIATE INVESTIGATORS			
				NAME: McQuade, M.J., MAJ, DC			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Ultrasonic Scaling; (U) Cemented Cast Restorations; (U) Cavitron Instrumentation; (U) Oral Prophylaxis.							
23. TECHNIC I/L OBJECTIVE, ^a 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To determine the safety of using ultrasonic scaling devices. Oral prophylaxis treatment presently requires a major time expenditure by the military dentist and hygienist of 4 man-hours per patient per year. The use of ultrasonics will decrease the time requirement by one-half. However, the effect of ultrasonic vibration on the integrity and strength of thin cement films is unknown. It is possible that the ultrasonic vibration may loosen many of the over 100,000 cast restorations placed by Army dentists each year. If this hypothesis is correct, the cost of repairing these iatrogenic failures would eventuate in a large dollar and time costs to the Government.</p> <p>24. (U) An in vitro study will be done using extracted teeth. Cast gold inlays placed in appropriately prepared teeth will be tested for retention before and after cavitron instrumentation using physical methodology which measures the tensile load required to remove the cemented inlays.</p> <p>25. (U) (76 02 - 76 06) Extensive testing has shown that high frequency vibrations delivered by the Cavitron do not impair the retention of properly cemented fixed prosthetic devices. Therefore, use of the Cavitron by the military dentist may safely include debridement and scaling of teeth restored by fixed castings.</p>							

^aAvailable to contractors upon originator's approval.

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8. DISSEM INSTR ^a	9. LEVEL OF SUM CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
75 07 01	D. CHANGE	U	U	NA	NL		
10. NO / CODES ^a	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
a. PRIMARY	61102A	3A161102B71R	04	086			
b. CONTRIBUTING							
c. CONTRIBUTING	CARDS 114 (f)						
11. TITLE (Precede with Security Classification Code) ^a							
(U) Acceleration of Wound Healing							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a							
002300 Biochemistry							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
66 07		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
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b. NUMBER: NA				FISCAL YEAR		1.5	
c. TYPE:				CURRENT		100	
d. KIND OF AWARD:				7T		17.5	
e. CUM. AMT.				77		2.0	
20. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				ADDRESS: Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Battistone, G.C., Ph.D.			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-2987			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Grower, M.F., MAJ, DC; Miller, R.A.;			
				NAME: Levin, L., Ph.D.			
22. KEYWORDS (Precede EACH with Security Classification Code) ^a							
(U) Wound Healing; (U) Bone Healing; (U) Electric Current;							
(U) Cyclic AMP; (U) Gingival Healing							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) Studies conducted by the Army in recent years show that 10-12% of combat wounds involve the maxillofacial apparatus. Further 7% of noncombat injuries requiring hospital care involve the maxillofacial region. This results in the loss of approximately 1,000,000 man-hours per year. The research objective is to accelerate or otherwise improve healing of the combat maxillofacial wound, demonstrate cost effective measures by decreasing medical requirements and hospital stay and effect a rapid return of the soldier to duty.</p> <p>24. (U) Studies on the effects of biochemical and physical factors to include chelate complexes, cyclic AMP, prostaglandins, scar inhibiting agents, <i>in vivo</i> growth factors and electric currents on the rate of healing in soft tissue and bone will be done. The mechanism of any beneficial alteration in healing effected will be investigated and pursued to human usage.</p> <p>25. (U) (75 07 - 76 06) A correlation found between gingival cAMP levels, length of survey and inflammation suggests that maintenance of cAMP levels during exposure of gingival wounds will enhance healing. Epinephrine in local anesthesia was found to keep gingival cAMP up and thus may promote healing. A study is in progress to determine if a PLA-cAMP dressing can stimulate collagen synthesis and retard epithelial growth in gingival wounds. Agents and means of elevating tissue cAMP in wounds are being sought. Electric currents up to 10μA have been found to have a characteristic and positive effect on bone healing. Work is in progress using constant currents on mandibular wounds in small animals and primates.</p>							

^aAvailable to contractors upon originator's approval.

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ACCELERATION OF WOUND HEALING

EFFECTS OF TIME OF EXPOSURE OF SURGICAL WOUNDS ON TISSUE AND BONE CYCLIC ADENOSINE MONOPHOSPHATE (AMP) AND CYCLIC GUANOSINE MONOPHOSPHATE (GMP) LEVELS

One of the major problems in military medicine is the morbidity associated with grossly contaminated combat wounds which are held open for prolonged periods prior to secondary closure and complete treatment in primary treatment centers. In this study an attempt was made to determine some of the biochemical changes which occur in wounds not closed immediately so more effective means of treatment can be devised. The effects of varying time periods of surgery on the gingiva and alveolar bone of Rhesus monkeys was used as a model system to study the changes in the cAMP and cGMP levels of tissues due to surgery. These nucleotides were selected for study since both cAMP and cGMP have been implicated in the regulation of fibroblastic growth, inflammation and bone metabolism. At the time of initial surgery full thickness gingival flaps exposing 5-6 mm of alveolar bone were made on the facial aspect of the mandible from the right to left lateral incisors of 9 monkeys. The control samples, taken at time 0, consisted of a 2 mm strip of alveolar bone and the attached gingiva over the right central and lateral incisors. The flaps on the left side in each of 3 monkeys were left reflected from the alveolar bone for 30, 60 and 120 minutes after which the alveolar bone and gingiva were removed as at time zero. The cGMP content of the control gingival tissues was 30-50 times less than the cAMP content. The cGMP content of the control alveolar bone was only 2.5 times less than the content of cAMP. The duration of surgery resulted in a marked reduction in the levels of cAMP found in the exposed gingival

tissues. However, neither the cAMP levels of alveolar bone nor the cAMP levels of gingiva or bone showed any significant changes due to the length of surgery. The coordinate decreases seen in the gingival levels of cAMP due to increasing length of surgery may be one of the factors responsible for the increased inflammation seen in soft tissues after prolonged surgery. This finding also suggests that the use of agents to maintain tissue cAMP levels during surgery and while contaminated combat type wounds are held open during movement of patients to primary treatment centers might result in less tissue inflammation, faster healing and decreased morbidity for the soldier. Agents and methods of elevating cAMP are being sought.

THE USE OF CYCLIC ADENOSINE MONOPHOSPHATE (cAMP)
AND POLYLACTIC ACID (PLA) DRESSINGS
TO AFFECT THE COURSE OF HEALING

Wound healing is a complex process in which epithelial as well as fibroblastic repair are occurring at the same time. The object of this study was to see if the rate of collagen synthesis in the wound could be stimulated while retarding the rate of epithelial growth. Lactic Acid and cAMP have both been shown to stimulate fibroblast growth in vitro while cAMP has been shown to stimulate fibroblast growth in vitro and in vivo and appears to regulate epithelial growth. It was therefore decided to see what effects PLA alone, and PLA containing cAMP had on wound healing.

The effects that dressings of PLA and PLA containing cAMP have on wound healing is being studied in 8 Rhesus monkeys. The model system used to study oral wound healing was gingivectomy done on the facial aspect of the maxilla and mandible from the lateral incisors to the 2nd

molar.

The gingivectomies done on each animal were done in equal quadrants; two control areas dressed with coe pack, one dressed with PLA alone and one dressed with PLA - cAMP. The plain PLA dressing was derived from a lyophilized methylene chloride solution of PLA. The PLA - cAMP combination was similarly prepared from a mixture of a methylene chloride - PLA solution with an absolute ethanol solution of cAMP. Tissue samples for biochemical analysis and histological evaluation were taken at zero time, 7 days and 14 days. Biochemical analyses are now in progress and include collagen, cAMP, protein and phosphodiesterase determinations.

EFFECT OF ANTI-INFLAMMATORY AND ANTI-PHOSPHODIESTERASE
AGENTS ON INFLAMMATION AND HEALING OF GINGIVA

It has been shown that gingival inflammation results in lowered tissue levels of cAMP. The purpose of this study was to evaluate practical methods of evaluating tissue cAMP levels to see if these procedures could be used in therapeutic treatment of facial wounds. The effects of local anesthesia containing 1:100,000 epinephrine was evaluated on monkey gingiva. It was shown that within 30 seconds after injection of local anesthetic containing epinephrine there is a 2-3 fold increase in the tissue cAMP levels. This increase is maintained for at least 5-10 minutes. The peak level occurs at 5 minutes. This suggests that the injection of local anesthetic containing epinephrine when surgical procedures are done in the oral cavity may provide a favorable local stimulus for the reduction of inflammation and initiation of repair due to the presence of increased cAMP levels in the tissue. Saline injections and xylocaine without epinephrine did not cause any increases in tissue cAMP levels.

In addition it was observed that injected local anesthesia containing epinephrine exhibited a systemic effect in that when the solution was infiltrated into the maxillae the tissue cAMP levels of the uninjected mandible after 1-2 minutes increased 2 fold over the levels seen in the uninjected tissue of the maxillae. This finding suggests that when the Army dentist is treating a patient with severe cardiovascular problems who is sensitive to exogenous epinephrine he should only use local anesthetics not containing epinephrine. This is because even though the local anesthetic may be only infiltrated locally there apparently is some escape of the epinephrine into the blood vessels flowing out of the area.

THE EFFECT OF ELECTRIC CURRENT ON BONE HEALING

In previous work we have found that direct electric currents in the range 2 to 10 microamperes, produced at the cathode, can stimulate bone healing in an experimentally produced injury in the guinea pig tibia. However the results were inconsistent. Apparently destructive unidentified products formed or accumulated at the anode irrespective of its placement either in soft tissue, remote from the injury site, or on bone a few millimeters from the injury site. Studies during the past year have been directed toward a continuing determination of the bone healing potential of electric currents, an elucidation of the causes of inconsistent results, means of eliminating undesirable anodic effects and the development of a model system in the guinea pig for studying the effect of electric current on the healing of mandibular bone.

Three dimensional reconstructions of bone deposition patterns under the influence of electric currents were made from more than 100 histologic sections through each of 5 bone healing sites. A roughly tear drop shape was noted with the bulk of the new bone deposited around the cathode and trailing off toward the anode placed 5 to 10 millimeters from the injury site. The results were distinctly different in control specimens in which less bone was usually deposited and an approximately spherical 3 dimensional shape was obtained.

It was found in continuous in-vivo recordings on experimentally injured animals that current flow directed across the injury sites varied 100 percent or more in episodes which lasted and recurred over highly variable periods. These episodes were noted with both stainless steel and platinum electrodes but were more pronounced when using the former. In experiments designed to deliver current levels in the range of 2 to 3 microamperes, healing inconsistency ranged from totally negative to positive results during the same evaluation periods. At higher current levels (5 to 10 μ A) and the same time frame results were always positive but highly inconsistent quantitatively. This was interpreted to mean that the healing inconsistencies noted were due directly to changing current levels since the higher current levels appeared to produce more bone.

The use of stainless steel electrodes were apparently responsible for the products deposited at the anode. These products included iron, nickel and chromium. The accumulation of nickel and possibly chromium salts could result in the localized destruction of soft tissue noted around anodes placed in soft tissue remote from the injury site.

Present investigations deal with efforts to deliver constant currents to injured mandibular bone. In order to eliminate current fluctuations

a workable minaturized battery pack containing a field effect transistor was designed for permanent attachment to the skull of the guinea pig. Electrode wires were directed subcutaneously from the constant current battery pack to a reproducible injury in the guinea pig mandible. As yet a suitable platinum electrode has not been tested to replace stainless steel electrodes. Two designs are contemplated. An alternative method of current delivery is being studied which involves a cable attachment to the guinea pig skull with the current source outside the cage. This system will also be used when studies are extended to the monkey.

PROTEIN HYDROLYSATE TISSUE REPAIR STUDY

This study was undertaken in response to the claims of a civilian investigator that a Protein Hydrolysate (composition not known) is effective in enhancing wound healing of soft and osseous mammalian tissues. Since wound healing and trauma are major areas of concern in military research, any substance showing promise in this field is worthy of investigation. Soft tissue excoriations and wounds were created on the abdominal area of male albino rats and osseous wounds were created in their tibias. Additionally, muscle defects were created in the biceps muscle of the front leg of male albino rabbits. The experimental substance was placed in these wounds and animals were sacrificed at various time intervals. Controls were simultaneously carried out. Histologic analysis on the basis of accelerated healing and/or improved healing in this experiment failed to show any improvement with the use of protein hydrolysate.

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL DD-DR&E(AR)036	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8. DISSEM INSTR ^a	9a. SPECIFIC DATA- CONTRACTOR ACCESS	9. LEVEL OF SUM A. WORK UNIT
75 07 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES: ^a	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
A. PRIMARY	61102A	3A161102B71R	04	067			
B. CONTRIBUTING							
C. CONTRIBUTING	CARDS 114 (F)						
11. TITLE (Precede with Security Classification Code) ^a (U) Problems Involved in Military Oral Health Care Delivery Related to Therapeutic Agents and Materials.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a 012600 Pharmacology							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
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17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:				PRECEDING		B. FUNDS (in thousands)	
D. NUMBER: ^a				FISCAL		76	
C. TYPE: NA				CURRENT		4.5	
E. AMOUNT:				77		19.5	
F. CUM. AMT.				77		88.1	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: ^a US Army Institute of Dental Research				NAME: ^a US Army Institute of Dental Research			
ADDRESS: ^a Washington, D.C. 20012				Division of Basic Sciences			
RESPONSIBLE INDIVIDUAL				ADDRESS: ^a Washington, D.C. 20012			
NAME: Cutright, D.E., COL, DC				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
TELEPHONE: 202-576-3484				NAME: ^a Grower, M.F., MAJ, DC			
21. GENERAL USE				TELEPHONE: 202-576-3678			
Foreign Intelligence Considered				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
22. KEYWORDS (Precede EACH with security Classification Code) ^a (U) Analgesics; (U) Sedation; (U) Nitrous Oxide; (U) Valium; (U) Mercury; (U) Polymers				ASSOCIATE INVESTIGATORS			
23. TECHNICAL OBJECTIVE, ^a 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)				NAME: Battistone, G.C., Ph.D.; Stanford, H.,			
23. (U) To evaluate the special military problems of drug storage, heat susceptibility, long-term drug potency, sterility of bulk items, lack of refrigeration in combat zones and delivery to the patient. To investigate drug hazards. To investigate the use of biodegradable polymers for the long-term, slow release delivery of drugs.				NAME: COL, DC; Jordi, H., CPT, MSC			
24. (U) Experiments will be conducted to evaluate pain killing medicaments used in military dental practice. The hazards involved in the use of various drugs will be studied and improved means of drug delivery will be investigated.							
25. (U) (75 07 - 76 06) Molecular weight and moisture have been found to be critical factors in the degradation times of PLA-PGA Mixtures used for long-term, slow release of medicaments in the body. Continued characterization work indicates the system has great potential. Stock eugenol in Army dentistry has been found to contain many impurities which could affect dental therapy. Continued study of N ₂ O use in Army dentistry suggests that proper ventilation is critical for dental personnel protection and could be a problem in some operatories. Data on the use of N ₂ O and valium for psycho-sedation indicate that 25 to 35% N ₂ O and 7.5 mg valium are adequate for most patients. An attempt to correlate antacid use with tooth erosion gave negative results. It was found that valium could be combined in an IV drip with aqueous medicaments if added at the time of administration. The study of blood mercury levels in dental personnel is continuing. A study of occupational stress in dentists has been done and the data is being evaluated.							

*Available to contractors upon originator's approval.

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EVALUATION OF DRUGS IN ORAL THERAPEUTICS

PREPARATION AND CHARACTERIZATION OF PLA-PGA MEDICAMENT COMBINATIONS FOR USE IN CONTROLLED RELEASE OF BIOLOGICALLY ACTIVE AGENTS

Copolymers of polylactic and polyglycolic acids (PLA/PGA) have shown themselves to be extremely useful in the search for compatible polymers that slowly degrade in the body tissues. They are ideal as a vehicle for the implantation and slow release of various drugs because they degrade to lactic and glycolic acids and so cause no detectable toxic response.

During the last year work has continued on the preparation and characterization of various polymer mixtures containing such medicaments as actinomycin D, provitamin D₃, adrenocorticotropin, ascorbic acid, and vitamin B₁₂. The method of preparation of the PLA/PGA polymer was further refined to include a sensitive gas chromatographic assay to test for residual solvent. This permitted the accurate prediction of the length of time each batch of polymer had to be freeze dried to remove all traces of solvent. During the course of our work we found that the molecular weights and hence the degradation times in the body of PLA/PGA polymers were extremely sensitive to contact with moisture in the air. Gel permeation chromatography revealed that polymer sent to us in the form of chips had a much lower average molecular weight than did polymer in the form of extruded rods. This was due at least in part to the larger surface area of the chips sample allowing it greater contact with air, although other factors in the polymer's production may be important also.

Gel permeation chromatography of PLA/PGA copolymers containing actinomycin D and provitamin D₃ was done and the results studied in some

detail. A method was developed for determining the molecular weight distribution of the copolymer. It was also possible to separate and quantitate actinomycin D and provitamin D₃. This method will now be used to measure the amount of medicament in a copolymer implant both before and after implantation in experimental animals to give us information on the rate of release of the drug as a function of time in vivo.

Results to date indicate that the PLA/PGA system has great potential for providing a suitable matrix in which to incorporate many drugs which can be slowly released in the body, providing military, medical and dental personnel with a new tool to use in the slow sustained release of various medicaments for prophylactic measures, in cases of chronic disease and delivered simultaneously to an injured site.

PREPARATION PURIFICATION AND USE OF EUGENOL FOR ZINC OXIDE/EUGENOL CEMENTS

Eugenol has been one of the most important essential oils used in dentistry. In conjunction with zinc oxide it has been used as a temporary filling material, a cavity liner for pulp protection, a capping material, for temporary cementation of fixed prosthesis, an impression material and the main ingredient of endodontic sealers. Until recently the reaction of the pulp to zinc oxide-eugenol cements was believed to be insignificant. However recent work has indicated that this is not the case. Since so many dental procedures utilize eugenol the improvement of its tissue compatibility could be of significant value in reducing the failure rates of such procedures.

A reverse phase high performance liquid chromatographic method has been

developed for assaying eugenol from normal Army supply channels. It was found that the eugenol assayed contained as many as twenty-five different components. Thus it is uncertain whether the observed toxic tissue responses are due to eugenol or one or more of its many impurities. Assay of Army issue eugenol as a function of time revealed very little change in composition even when the eugenol was left exposed to the atmosphere, indicating that the bulk of the impurities are present when the eugenol is received from the manufacturer.

We are at present developing a preparative method for the purification of rather large amounts of eugenol and will test the purified product in animals to determine if the tissue responses are reduced.

Since so many dental procedures in the Army utilize eugenol one way or another it would be a great aide to the Army to improve the materials used in order to reduce complications and failure rates. This in turn should save valuable chair time and make the most efficient use of limited dental resources.

THE SEPARATION OF THE GLUCURONIDES OF THE OPIUM ALKALOIDXS USING HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC)

In mammals the bulk of the opium alkaloids i.e. morphine, heroin, codeine etc. are conjugated with a glucuronic acid residue and excreted by the kidneys. Various workers have separated the free opium alkaloids in the past but no one has been able to resolve the glucuronides. Since humans excrete most of the opium alkaloids as their glucuronides it would be desirable to be able to determine these opium derivatives in a simple urine assay which would form the basis for a rapid screening method to test for drug abuse.

In the course of determining the potential of HPLC in dental research we found that HPLC could separate and quantitate the above mentioned glucuronides by 2 methods. With an acetonitrile-water gradient as eluent either a μ -Bondapack C_{18} column or a μ -Bondapack Carbohydrate column can be used. In both methods we were able to detect the glucuronides by their ultraviolet absorbancies at 285 nm. Morphine-3-glucuronide isolated from dog urine and supplied by the Walter Reed Army Institute of Research was used as a standard in this work. Both methods are rapid (less than 20 minutes per sample) and appear to hold great promise in developing a rapid screening method to test Army personnel for opium alkaloid use and for monitoring the plasma levels of opiates as a result of medical treatment.

MEASUREMENTS OF WASTE GAS CONTAMINATION FROM N_2O SEDATION UNITS IN DENTAL OPERATORIES

Studies have intimated that chronic exposure to trace concentrations of anesthetic gases pose a health hazard to medical and dental personnel. The purpose of this study was to sample the air in dental operatories where N_2O was being used in order to document the amount of exposure of the dentist and his assistant. The Miran 101 N_2O analyzer was used. Preliminary results show peak concentrations in excess of 6000 PPM (0.6%) exist near the exhalation valve of the nose piece and drop off to approximately 1000 PPM (0.1%) at a distance of 5 ft. measured horizontally from the valve opening.

Turning the opening of the exhaust valve away from the operator lowered the measured concentrations by a factor of 50%. Ventilation - especially non-recirculating type - also lowered the ambient concentrations

by a similar factor. The figures suggest that if a unit is being used regularly in a poorly ventilated room then the purchase and use of scavenging equipment should be considered, and that ancillary personnel be advised as to their exposure and possible consequences therefrom. This information is being disseminated to the Corps and included in educational courses on nitrous oxide use within the Army.

NITROUS OXIDE AND VALIUM IN GENERAL DENTAL PRACTICE

Data is being collected on both nitrous oxide and valium use in general dental practice. Parameters which are being evaluated include: blood pressure changes, idiosyncratic reactions, dosage levels, etc. Data on almost 2000 administrations of nitrous oxide have been collected and are currently being analyzed. Preliminary results indicate psychosedation is obtained in the range of 25-35% nitrous oxide; titration virtually eliminates the incidence of nausea and side-effects such as frontal sinus headaches. Changes in blood pressure are not statistically significant. Preliminary findings with valium indicate that the most common dosage is about 7.5 mg to achieve adequate psychosedation in dental patients. Blood pressure changes are also minimal with this modality. Additional information will be available after the data are completely analyzed by the computer center. These rapid and easily administered methods of pain control increase the numbers of patients treated and decrease patient anxiety.

PH CHANGES IN ORAL ANTACIDS

It has recently been reported that some patients habitually using antacid tablets show erosion of their teeth. The aim of this study was to measure the pH of the antacids available in the Army pharmacy system to determine if any of them exhibited properties which might be associated with tooth erosion due to excessive acid or basic pH's. A total of 9 brands were evaluated as follows: Bismuth Subcarbonate, Milicon, Amphogel, Sodium Bicarbonate, Gelusil, Mylanta II, Rio pan, Ba Sajel Tablets, and Dicarbosil. No significant pH changes were seen to account for the clinical observation. Experiments on abrasiveness will be done to determine if this might account for the changes seen.

IN VITRO EVALUATION OF THE SOLUBILITY OF VALIUM IN PLASMA AND SALINE DRIPS

Valium is currently one of the most popular drugs in the psychosedative management of the apprehensive dental patient used in Army dental clinics. Various techniques are advocated for its administration from direct injection into the vein to injection of the drug into a running IV. However, the manufacturer states that the drug should not be added to IV fluids or other solutions or drugs. Presumably this is because of the formation of a cloudy precipitate immediately upon addition to aqueous solutions. The present study was undertaken because of the lack of information concerning what happens when an IV solution of Valium-saline enters the blood, and because numerous persons advocate the addition of Valium to the running IV.

The data obtained from the present study indicate that Valium-saline solutions (similar to those produced in the running IV drip) immediately resuspend in plasma in vitro and hence should exhibit the same behavior in vivo. It is essential however that the valium be added to the saline IV drip only during the time of administration so that precipitation will largely be avoided before the solution enters the blood. If the Valium and saline IV solution are mixed and set aside for later use complete precipitation of the Valium will result and the solution will be unusable. This study is continuing.

If these studies show that Valium can be maintained in a running IV, military patient treatment will be simplified and speeded.

THE DETERMINATION OF BLOOD MERCURY LEVELS IN DENTAL PERSONNEL

In previous work it was found that mercury hygiene problems existed in some Army dental clinics. By comparison a study of civilian dentists indicated that in general they practice better mercury hygiene than their military counterparts. There was an indication however that civilian dentists in practice 15 or more years begin to show higher levels of body mercury than the younger dentist. In order to continue the comparison of mercury hygiene among Army and civilian dentists 361 civilian general dentists in practice for 15 or more years were surveyed for blood mercury levels as an index of the body burden of mercury. The results did not show the trends indicated in the previous study. The conclusion remains that civilian dentists practice better mercury hygiene than their Army counterparts. A more extensive study of Army dental personnel is in progress which should help to pinpoint mercury hygiene problems that

continue to exist in Army dental clinics.

CORRELATION OF STRESS OF DENTAL PRACTICE WITH CATECHOL-O-METHYL-TRANSFERASE
ACTIVITY IN BLOOD OF DENTISTS

Dentistry has been reported by some workers to be a particularly stressful occupation. Dental practice in the military differs significantly in some aspects from civilian practice and these differences could add to the levels of stress suggested for civilian practice. The 1975 ADA health screening survey presented the opportunity to test an objective means of evaluating stress biochemically in a relatively large sample of civilian dentists. These data may serve as a baseline for evaluating the relative stress levels seen in military dental practice and possibly lead to improving the quality of oral health care delivery. Blood samples from 200 dentists were analyzed for Catechol-o-Methyl-transferase activity. This enzyme is thought to change in different stress situations. The samples have been analyzed and statistical evaluation is in progress.

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2. Cutright, D.E., Brady, J.M. and Miller, R.A.: Single Dose Long Duration, Subcutaneous Drug Administration, J. Oral Med. 30(1):5-7, (1975).
3. Grower, M.F., and Ayer, W.A.: Solubility of Injectable Valium in Plasma and Saline, Anesth. Prog. 23:45-47, (1976).
4. Ayer, W.A. and Getter, L.: Survey of Hand Steadiness of General Dentists. J. Dent. Res. (Spec. Issue) 55B #880 (1976).
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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA- CONTRACTOR ACCESS	9. LEVEL OF SUM
75 09 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
a. PRIMARY	61102A	3A061102B71R	04	068			
b. CONTRIBUTING							
c. CONTRIBUTING	CARDS 114(f)						
11. TITLE (Precede with Security Classification Code)*							
(U) The Use of Electric Current as an Anesthetic Agent							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS*							
012900 Physiology; 002400 Bioengineering							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
72 01		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING			
b. NUMBER* NA				FISCAL 76		0.5	
c. TYPE:				YEAR 77		11	
d. AMOUNT:				77		0.5	
e. KIND OF AWARD:				f. CUM. AMT.		5	
19. RESPONSIBLE ODD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME:* US Army Institute of Dental Research				NAME:* US Army Institute of Dental Research			
ADDRESS:* Washington, D.C. 20012				Division of Dental Materials			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME:* Huget, E.F., LTC, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3092			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Hertert, R., 1LT, MSC			
				NAME: deSimon, L.			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Electroanesthesia; (U) Electric Current;							
(U) Analgesia; (U) Regional Block							
23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To develop effective electroanalgesia equipment and techniques for easier and safer management of "anesthetic risk" patients requiring immediate and extensive treatment of combat injuries of the oral-facial region. The simplicity of technique and equipment make this method ideally suited for use in field medical surgical practice, in the treatment of large numbers of patients in mass casualty situations and in the fixed dental treatment facility. The success of this project will establish cost effective measures which will eventuate in vast dollar savings.</p> <p>24. (U) To construct equipment for the synthesis and delivery of electroanalgesic currents. This will be followed by studies designed to determine optimum currents and frequencies. Methods of application and administration through time and intensity changing currents and chemical adjuncts will be studied. The final study will involve a demonstration of the safety of the use of this equipment.</p> <p>25. (U) (75 09 - 76 06) The clinical phase of this research has continued at the "primate" level. To date, the USAIDR studies have demonstrated the feasibility, safety and simplicity of general electroanesthesia. Conventional restorative, endodontic and oral surgical procedures were accomplished readily at low current levels (4 ma avg.). Life signs of test subjects remained within normal limits. Recovery of the animals on completion of the procedures occurred within 5 minutes. Reduction of postanesthetic drug morbidity and decreased potential for alteration of homeostatic mechanisms are unique of the technique.</p>							

*Available to contractors upon originator's approval

PII Redacted

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8. DISSEM INSTR*	9. SPECIFIC DATA- CONTRACTOR ACCESS	9. LEVEL OF SUM A. WORK UNIT
75 07 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO / CODES*	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
A. PRIMARY	61102A	3A161102B71R		04		065	
B. CONTRIBUTING							
C. CONTRIBUTING	CARDS 114 (F)						
11. TITLE (Precede with Security Classification Code)* (U) Identification and Control of Oro-facial Infections of Military Importance							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 010100 Microbiology							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
66 07		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:				PRECEDING			
B. NUMBER: NA				FISCAL YEAR		2.0	
C. TYPE:				CURRENT		100	
D. KIND OF AWARD:				77		31.9	
E. CUM. AMT.				4.0		143.6	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Basic Sciences			
				ADDRESS: Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Gross, A., COL, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3764			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Horton, J.E., COL, DC; Tinanoff, N.N.			
				NAME: MAJ. DC			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Cold Sterilization; (U) Contaminated Dental Units; (U) Dry Heat Sterilizers; (U) Transient Bacteremia; (U) Polymers; (U) Plaque Prevention							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To investigate the source and treatment of oro-facial infections encountered in field conditions, foreign countries and diverse climates. To evaluate the special agents, instruments and chemicals necessary under military conditions.							
24. (U) Oro-facial infections of significance in the diverse military environment will be studied by microbiological, immunological and electronmicroscopic methods. Possible sources of oral infections will be evaluated and the effectiveness of commercially available as well as in-house designs will be studied for their ability to control or prevent oral infections.							
25. (U) (75 07 - 76 06) Testing of a highly effective cold sterilization method developed by USAIDR continues. Microbial contamination of dental unit water supplies have been identified as a potential problem in Army dental clinics and preventive measures are being devised. Thirteen different endodontic dry heat sterilizers have been evaluated and recommendations made for Army use. Two commercial dressings were found to have a cytotoxic potential which might retard healing. An ultrasonic bone chisel was evaluated and found to minimize surgical trauma. Means of minimizing local bone disorders resulting from trauma are being studied. A study of the role of immunologic deficiencies on oral health is in progress. Methods of incorporating antigens into PLA-PGA for slow in-vivo release are being investigated. Fluoride mouthrinses have been found to be excellent plaque preventives. Evidence has been obtained that tooth enamel structure differences may determine its susceptibility to disease.							

* Available to contractors upon originator's approval.

DD FORM 1498

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 65 AND 1498-1, 1 MAR 66 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

PUBLICATIONS

1. Huget, E.F., Hertert, R.S., Cutright, D.E. and de Simon, L.B.: Electroanesthesia. Proceedings of the Army Science Conference, 1976, (In Press).
2. Hertert, R.S., Huget, E.F., Cutright, D.E. and de Simon, L.B.: Electroanesthesia for Military Application, Mil. Med., (In Press).
3. Hertert, R.S., Huget, E.F., Cutright, D.E. and de Simon, L.B.: Electroanesthesia in Dentistry, J. Dent. Res. (Spec. Issue) 55 B #1068 (1976).

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8. DISSEM INSTR ^a	9a. SPECIFIC DATA - CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	9. LEVEL OF SUM A. WORK UNIT
75 07 01	D. CHANGE	U	U	NA	NL		
10. NO./CODES ^a	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER			
A. PRIMARY	61102A	3A161102B71R	04	065			
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C. CONTRIBUTING	CARDS 114 (f)						
11. TITLE (Precede with Security Classification Code) ^a (U) Identification and Control of Oro-facial Infections of Military Importance							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a 010100 Microbiology							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
66 07		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:				PRECEDING		FUND (In thousands)	
B. NUMBER ^a NA				FISCAL YEAR		76 2.0 100	
C. TYPE:				CURRENT		77 31.9	
D. KIND OF AWARD:				77 4.0		143.6	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Basic Sciences			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Gross, A., COL, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3764			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Horton, J.E., COL, DC; Tinanoff, N.N.			
				NAME: MAJ. DC			
22. KEYWORDS (Precede EACH with Security Classification Code) ^a (U) Cold Sterilization; (U) Contaminated Dental Units; (U) Dry Heat Sterilizers; (U) Transient Bacteremia; (U) Polymers; (U) Plaque Prevention							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To investigate the source and treatment of oro-facial infections encountered in field conditions, foreign countries and diverse climates. To evaluate the special agents, instruments and chemicals necessary under military conditions.							
24. (U) Oro-facial infections of significance in the diverse military environment will be studied by microbiological, immunological and electronmicroscopic methods. Possible sources of oral infections will be evaluated and the effectiveness of commercially available as well as in-house designs will be studied for their ability to control or prevent oral infections.							
25. (U) (75 07 - 76 06) Testing of a highly effective cold sterilization method developed by USAIDR continues. Microbial contamination of dental unit water supplies have been identified as a potential problem in Army dental clinics and preventive measures are being devised. Thirteen different endodontic dry heat sterilizers have been evaluated and recommendations made for Army use. Two commercial dressings were found to have a cytotoxic potential which might retard healing. An ultrasonic bone chisel was evaluated and found to minimize surgical trauma. Means of minimizing local bone disorders resulting from trauma are being studied. A study of the role of immunologic deficiencies on oral health is in progress. Methods of incorporating antigens into PLA-PGA for slow in-vivo release are being investigated. Fluoride mouthrinses have been found to be excellent plaque preventives. Evidence has been obtained that tooth enamel structure differences may determine its susceptibility to disease.							

PII Redacted

IDENTIFICATION AND CONTROL OF ORAL INFECTIONS

EVALUATION OF LIQUID STERILANTS IN CONJUNCTION WITH ULTRASONICS AS A RAPID MEANS OF STERILIZATION

Previous work in our laboratory has shown that an aqueous solution of 5% glutaraldehyde and 4% formaldehyde when used in conjunction with ultrasonics is an effective and rapid liquid chemical sterilant. Additional preliminary and confirmatory AOAC (Association of Official Analytical Chemists) spore tests have confirmed that vacuum dried spores of Bacillus subtilis and Clostridium sporogenes are killed in one hour at room temperature and 220 watts power. None of the most commonly used agents for liquid chemical sterilization is capable of sterilization in such a short time.

The above mixture was also tested without ultrasonics. The preliminary AOAC spore tests have indicated that less than three hours exposure at room temperature will not accomplish sterilization. The most commonly used liquid chemical sterilant requires 10 hours.

The following studies are now under way to determine possible deleterious effects of the 5% glutaraldehyde-4% formaldehyde mixture on metal, plastic and rubber. The results of 22 hours submersion in the mixture at room temperature at 220 watts power revealed no corrosion and/or cutting edge dullness of instruments such as curettes, scalers and mouth mirrors. Plastic impression trays, spatulas and syringes as well as rubber polishing wheels of various sizes and textures also showed no signs of deterioration or discoloration. Steel burs including those made of tungsten carbide and diamond instruments etc. are now being tested. While additional testing of the effects of this sterilization procedure on dental instruments and determination of the shelf life of the mixed preparation are required, this new sterilization method developed by

USAIDR appears very promising and should prove to be a very important and cost effective procedure for the military.

MICROBIAL CONTAMINATION OF DENTAL UNITS AND ULTRASONIC SCALERS

A frequently unrecognized potential health hazard in military dentistry is microbial contamination of dental units and accessories. Bacterial colonization of dental units with very high bacterial counts in water from high-speed handpieces (HSH) and air-water syringes (AWS) has been reported. Little information is available on the extent of microbial contamination of ultrasonic scalers (US). We therefore tested water samples from 12 dental units at 2 Army dental clinics. Samples were obtained in the morning prior to regular use from HSH, AWS, and US attached to these dental units. Additional samples were collected after flushing the lines for two minutes. The bacterial counts (CFU) per ml before flushing ranged from 60-190,000, 5700-3.3 million, and 5500-2.6 million for AWS, HSH and US samples respectively. After 2 minutes flushing these counts were reduced to 0-2300, 600-570,000 and 35-120,000 for AWS, HSH, and US respectively. All of these levels are extremely high and exceed the safety limits for human consumption. Flushing the lines for 2 minutes reduced the microbial concentration, but complete elimination of all bacteria was not achieved. The dangers of forcing bacteria from wounds, gingival crevice or periodontal pockets into the circulation poses a serious problem even in the healthy military population. This problem is magnified greatly in the soldier patient whose health is compromised via disease or immuno-therapy. The possible danger of forcing into the circulation microbial contaminants through gingival crevice or periodontal pocket, particularly in the compromised host, should not be underestimated.

Obviously there is a need in the military dental clinic for control of bacterial contamination of dental unit water lines. The first approach to the solution of this problem is now being investigated.

Different membrane filters have been attached to the water lines of dental units and the ultrasonic scalers at different locations. Preliminary results indicate that decontamination of water lines by this method is feasible.

MICROBIAL CONTAMINATION OF TOOTHBRUSHES

Various toothbrush holders and containers have been manufactured and proposed for use in order to limit the number of microorganisms which may contaminate toothbrushes. Systems to allow faster organism death through drying or to prevent contamination by a tight enclosure have been commonly used. No guidelines for storage are given in military hospitals or other installations where cross contamination or recontamination may occur. Therefore, this study was undertaken. Toothbrushes were contaminated with microorganisms from dental plaque and also were non-contaminated with other organisms. Preliminary results indicate that storage by hanging in air does not provide for faster organism death than enclosure in vented containers. Enclosed vented containers prevented contamination by the motile test organism, Pseudomonas aeruginosa.

ENDODONTIC DRY HEAT STERILIZER EFFECTIVENESS

The effectiveness of the chairside decontamination of endodontic instruments has recently been investigated with mixed results. Varying test results were related to the efficiency of the sterilizer and the heat resistance of

test organisms. This study was undertaken to delineate the effectiveness of dry heat endodontic sterilizers. Thirteen sterilizers were tested for operating temperatures and for heat-up time. Further, Bacillus subtilis var. niger, a heat resistant spore forming organism was inoculated onto endodontic files, porcelain penicylinders and suture loops as used in standard spore tests. Six carriers of each type were exposed to salt at 220°C for 5, 10, 15 and 20 seconds and then cultured. Evaluation of 13 dry heat sterilizers showed that 7 achieved and maintained an adequate temperature level and that 6 did not. Of those which reached operating temperatures the heat-up times varied from 15 minutes to 3½ hours. Test organisms were completely eliminated only when 20 seconds of immersion time in a salt medium were used. The results indicated that:

- 1) Dry heat sterilizers effectively sterilize small endodontic instruments in 15 seconds.
- 2) Materials with a greater bulk or more porous surface require a longer time for sterilization.
- 3) Untested sterilizers may not reach adequate temperature levels.
- 4) Sterilizers must be pre-heated for a least one hour prior to use.

THE INCIDENCE OF TRANSIENT BACTEREMIA DURING ORAL SURGICAL DRESSING CHANGE

Incidence of transient bacteremia during the dressing change and suture removal one week after surgery was determined on twenty patients undergoing treatment for alveolar bone resorption. Each patient contributed 20 ml of blood prior to the dressing change and an additional 20 ml during suture removal. The samples were cultured both aerobically and anaerobically.

Bacteria were demonstrated in five out of twenty post-operative cultures (25%). This incidence approached statistical significance at the 0.05 level. All species were identified as belonging to the genus *Streptococcus*. None of the blood specimens obtained prior to dressing change exhibited bacterial growth.

Although the incidence of bacteremia in this study was not statistically significant at the 0.05 level, it may be clinically significant that five out of twenty patients demonstrated transient bacteremia. Since the potential for bacteremia has been demonstrated, it is recommended that antibiotic coverage be extended to include at least the first post-operative dressing change to protect the high risk military patient from bacterial endocarditis.

CELL-MEDIATED PATHOGENETIC MECHANISMS OF SOFT TISSUE DESTRUCTION AND REPAIR:

In the military the treatment of soldiers with alveolar bone loss often requires extensive surgical procedures. Proper management in treatment during the post-operative period often determines differences in the healing of the surgerized tissues, as well as the amount of recuperative time needed which is time lost from duty. Currently military practitioners favor two commercial dressings for their bacteriostatic properties as supportive therapy in the healing phase of such surgerized tissues. However, little knowledge is available concerning the effects of these dressings on tissue cells involved in the healing process.

It was found that soluble extracts derived from both commercial wound dressings have the potential to release lysosomal enzymes from cells involved

in the reparative process of healing wounds. Increased amounts of acid phosphatase, B-glucoronidase, lysozyme, and lactic dehydrogenase were found in supernatant fluids of cultured human granulocytes upon exposure to soluble preparations extracted from these dressings. This response was found dependent upon concentration of the extracted material by testing serial dilutions prepared from the stock preparation. Further results indicated that such release of lysosomal enzymes from purified human granulocytes is directly related to the cytotoxic potential of the extracted material.

Considerations in the treatment of wounds to prevent protracted healing is of paramount importance by military practitioners for the soldier patient. During the initial phases of repair following surgery, granulocytic cells infiltrate into the forming clot and also into the organizing tissues. Cytotoxic disruptions in these cells at this time may influence the post-operative course and healing in such wounds. Further study is necessary to define results of these findings upon the reparative process. This study is continuing.

PATHOGENETIC MECHANISMS OF OSTEOCLASTIC BONE RESORPTION:

Surgical procedures involving the removal of mineralized bone tissue often require traumatizing forces which excessively damage patient tissues. The result is retardation of the healing process and extension of the convalescent period. We have previously investigated a new surgical method in the removal of alveolar bone using a chisel-shaped instrument powered through ultrasonic energy. Histologic comparisons of the osseous defects produced in the dog with the ultrasonic-powered instrument and a standard surgical chisel revealed similar appearances in the cut bony edge and a similar rate of bone healing. In contrast, slower healing was observed in

defects produced using a conventional rotary bur. Our study of ultrasonic instrumentation has been extended to a clinical population for the removal of alveolar bone and in the surgical removal of teeth. During surgery, hemorrhage was minimal and the operative field remained moist and free of debris. Post-operatively, patient discomfort was minimal with no evidence of swelling or other complications. Histologically, osteocytes were observed within lacunae in close proximity to the cut surface. Tissues underlying the cut-bone appeared normal, with no evidence of cellular or vascular damage.

This new surgical method of removing mineralized tissue in soldiers, necessitated through either battle-injury or disease, enhances the healing in such wounds. Thus, protracted periods of post-operative care and convalescence may be reduced, allowing an earlier return of the soldier to duty.

PATHOGENIC MECHANISMS OF OSTEOCLASTIC BONE RESORPTION:

Localized disorders of bone tissue resulting in progressive osseous destruction, such as chronic osteomyelitis or granulomatous lesions in bone, are frequent sequelae of battle injuries occurring in the maxillo-facial regions. Treatment of such conditions by military practitioners often requires heroic and extensive procedures, and yet, at present, is marginally effective since etiologic causative and pathogenic mechanisms are unclear. Current endeavors are investigating the role of our newly detected biological activity, the lymphokine Osteoclast Activating Factor (OAF), which is believed responsible for inducing osteoclastic bone resorption occurring as a result of such inflammatory conditions.

Prior results indicated that the production of OAF was dependent upon intimate contact between the macrophage and activated lymphocyte. Significant

new accomplishments reveal that OAF may be produced in vitro by both the bone marrow-derived as well as the thymic-derived lymphocytes. In addition, interactions of OAF with parathyroid hormone (PTH) and prostaglandin E_2 (PGE_2) were examined largely because all three agents are potential mediators of both neoplastic and inflammatory bone loss. Effects on bone resorption in vitro by additions of PTH and PGE_2 to submaximal concentrations of OAF were found to be additive. However, PTH and PGE_2 were unable to increase resorption further in the presence of high concentrations of OAF.

Since 3', 5' adenosine monophosphate has been implicated in the regulation of inflammation and bone metabolism, investigations into the actions of these humoral mediators on cyclic nucleotides is required before considerations towards therapeutic interception may be pursued. Preliminary studies reveal that treatment with OAF, unlike PTH and PGE_2 , did not increase 3', 5', adenosine monophosphate concentrations in cultured bones. Further studies are currently in progress.

At present the effects of OAF observed in vitro are consistent with the nature of lesions in localized disorders of bone. Further elucidation of the action of OAF to result in specific therapeutic management of such bone loss are currently being pursued. The goal is a reduced convalescence and rehabilitation period for the injured soldier.

EFFECTS OF IMMUNOSUPPRESSION ON THE ORAL CAVITY

The objective of this research is to determine the role of immunologic deficiencies on oral health and disease. The presence, absence, increase or decrease in immunoglobulins elaborated in the saliva as well as other fluids and certain tissues may have a profound effect on the oral health of the soldiers. The ability of certain drugs, taken over the long term, to

induce immunologic deficiencies provides a means of studying the relation of immune factors to oral disease and is the subject of current studies.

Methodology for quantitation of immunoglobulins IgM, IgG, and IgA in tissue, saliva and serum has been perfected along with an assay for free secretory component. The biological significance of secretory component is unknown and therefore it is of interest to apply this assay as a screening test in determining qualitative and quantitative presence of this glycoprotein in the compromised host as well as in various disease states.

Immunoglobulin quantitation of dilantin hyperplasia, chronic and acute alveolar bone loss, moderately inflamed and normal gingiva has revealed presence of IgG and IgA but undetectable levels of secretory piece and secretory IgA.

Approximately 25% of dilantin hyperplastic tissue specimens assayed have exhibited low or undetectable levels of IgA. Results to date have indicated an IgA range in normal gingiva of .226 - 1.31 ug/mg and IgG of 1.88 - 6.76 ug/mg of dry lyophilized tissue using lyophilized World Health Organization serum as standard. IgM has been detected in some specimens by radial immunodiffusion using low antibody concentrations.

Conclusions concerning the significance of assayed values of IgA, IgG, and IgM await analysis of more specimens and a resulting statistical analysis of the data.

SLOW RELEASE OF ANTIGENS FROM BIODEGRADABLE PLA-PGA POLYMERS

Prior studies have elucidated the problem involved in incorporation of proteins into biodegradable polymers as one of denaturation by solvents used to solublize the polymer. Tetanus toxoid and human albumin have been incorporated into the polymer by dissolving the polymer antigen mixture in methy-

lene chloride and immediately aerosolizing with a spraying apparatus. The resulting polymer powder was then assayed immunologically to assay for retention of antigenicity. Retained antigenicity for albumin but complete destruction for tetanus toxoid has resulted in further studies to evaluate new antigens, solvent systems, and methods for incorporation.

INVESTIGATION OF PLAQUE INHIBITING AGENTS USING AN IN VIVO PLAQUE MODEL

An in vivo plaque model system was used to test various mouthrinses which might disrupt the capacity of bacteria to attach to tooth enamel. In this system enamel cylinders from extracted human molars were embedded in a maxillary appliance and worn by two different individuals for various intervals. Sodium fluoride when used once a day as a mouthrinse appeared to have little influence on two day plaque development, but when used twice a day detachment of bacteria was seen. Stannous fluoride used either once or twice a day reduced the microbiota in early plaque formation drastically. It appeared that the variation in microbial colonization was due to alteration of adherence of bacteria to bacteria and bacteria to enamel.

Stannous fluoride mouthrinse was further tested with microbiologic techniques to quantitate the reduction of bacteria in early plaque samples. A reduction of approximately 40 times or 97% was found in the SnF_2 rinse as compared to a water rinse. Electron microscopy confirmed the large reduction in bacteria noted with microbiologic techniques.

Other fluoride mouthrinses have been investigated for possible antiplaque potential. Amine fluorides and sodium hexafluorostannate have also been noted to reduce bacterial accumulations on enamel. The preventive dentistry impli-

cations of such a procedure in the military especially in a high stress situation are very large.

Plastic restorative materials have also been shown to reduce bacterial attachment to tooth enamel. However, certain acid etch resins can not adhere to tooth enamel because of a surface prismless zone which prevents proper etching of the enamel needed for the bond between the plastic and the tooth. The prismless zone was observed with electron microscopy in primary and permanent teeth. Large variations were found in the presence of this surface structure. Orientation of the enamel crystalites was noted to control the etch characteristics in these teeth. Scanning electron microscopy was used to determine the usefulness of cutting burs, sandpaper disks, and increased acid etch time on enhancing retentive tag formation of acid etch restorations in primary teeth. Although all procedures enhanced tag formation, removal of the prismless zone with a small round bur appeared to be the most beneficial. This is an important finding to the military due to the very large percentage of failure of contemporary adhesive resins.

TEM, SEM, AND MICROBIOLOGIC INVESTIGATION OF AN IN VIVO PLAQUE MODEL SYSTEM

The initial phases of plaque formation were investigated to better understand this process so that methods could be developed to alter dental plaque formation. Methods for modification or control of plaque formation would be highly significant in controlling oral disease in the soldier. Enamel cylinders prepared from surface enamel of extracted teeth were worn by researchers in a modified Hawley appliance. The proportions of streptococci in two day old plaque samples were noted to vary on the different cylinders even though they were worn at the same time in the same mouth and

in adjacent areas. It is believed that the differences in bacterial attachment may be due to the enamel since each cylinder was derived from teeth on different individuals. The attachment of bacteria to teeth may thus be related to the specificity of enamel. This study is continuing.

PUBLICATIONS

1. Brady, J.M., Gray, W.A. and Lara-Garcia, W.: Localization of Bacteria on the Rat Tongue with Scanning and Transmission Electron Microscopy, *J. Dent. Res.*, 54(4): 777-782, (1975).
2. Gross, A., Barnes, G.P. and Lyon, T.C.: Effects of Tongue Brushing on Tongue Coating and Dental Plaque Scores, *J. Dent. Res.*, 54:1236, (1975).
3. Horton, J.E., Oppenheim, J.J., Chan, S.P. and Baker, J.J.: Relationship of Transformation of Newborn Human Lymphocytes by Dental Plaque Antigen to the Degree of Maternal Periodontal Disease, *Cellular Immunology*, 21:153-160, (1976).
4. Mergenhausen, S.E., Wahl, L.M., Horton, J.E. and Raisz, L.G.: The Role of Lymphocytes and Macrophages in the Destruction of Bone and Collagen, *Ann. New York Acad. Sci.*, 256:132-140, (1975).
5. Raisz, L.G., Luben, R.A., Mundy, G.R., Horton, J.E. and Trummel, C.L.: Effect of Osteoclast Activating Factor from Human Leukocytes on Bone Metabolism, *J. Clin. Investig.*, 56:408-413, (1975).
6. Tinanoff, N.: The Significance of the Acquired Pellicle in the Practice of Dentistry, *Am. Soc. Dent. Child.*, 18:20-24, (1976).
7. Tinanoff, N., Glick, P.L. and Weber, D F.: Ultrastructure of Organic Films on the Enamel Surface, *Caries Res.*, 10:19-32, (1976).
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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL	
				DA OF 6034	76 07 01	DD-DR-6(AR)636	
3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8A. DES'N INSTR'N	8B. SPECIFIC DATA- CONTRACTOR ACCESS	9. LEVEL OF SUM
75 07 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES ^a	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	61102A	3A161102B71R		04		020	
b. CONTRIBUTING							
c. CONTRIBUTING	CARDS 114 (f)						
11. TITLE (Precede with Security Classification Code) ^a (U) Identification of Factors Predisposing to Treatment Acceptance by the Soldier Patient.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a							
013400 Psychology							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
73 01		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (in thousands)	
d. NUMBER: NA				FISCAL YEAR		52	
c. TYPE:				CURRENT		2	
e. KIND OF AWARD:				77		9	
f. CUM. AMT.				0.2			
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Clinical Sciences			
				ADDRESS: Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Ayer, W.A., MAJ, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3443			
				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
21. GENERAL USE				ASSOCIATE INVESTIGATORS			
Foreign Intelligence Considered				NAME: Tsaknis, P., LTC, DC			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Occupational Stress; (U) Dental Education; (U) Psychosomatic Disorders; (U) Stress in Dentistry.							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with security Classification Code.)							
<p>23. (U) Under Title X of the Military Code the Army is authorized to routinely provide extensive and effective, quality dental treatment to the soldier. However, since the possibility of conflict is ever present, combat readiness is stressed via delivery systems which bring dentistry to the soldier to assure his oral state does not preclude performance of duty. This is different from the civilian system where the patient seeks treatment. It should be noted however, that no matter what delivery system is utilized it is neither comprehensive nor effective enough to assure compliance by the patient. Factors must be identified which will motivate the soldier to initiating, accepting, and maintaining dental treatment and thereby eliminating potential periods of ineffectiveness and lost duty time. These same factors will also enhance professional productivity and reduce greatly the treatment costs.</p> <p>24. (U) Identify personality components unique to military patients which have a direct influence on treatment outcome. Identify which patients will respond to given methods of influencing preventive dental care. Identify those occupational factors which affect dental health care delivery by dental personnel. Identify those educational factors which lead to the best oral health care delivery.</p> <p>25. (U) (75 07 - 76 06) The preliminary findings of a psychological study intended to evaluate occupational stress in dental personnel suggests that dentistry as a profession is less stressful than hypothesized in previous reports. A study is in progress to evaluate the importance of the masters degree in education as it relates to the accreditation of Army residency programs and the effectiveness of such degrees in the preparation of military dental educators.</p>							

PII Redacted

EFFECT OF PERSONALITY FACTORS IN ORAL HEALTH CARE DELIVERY

SURVEY OF PSYCHOSOMATIC DISORDERS AND JOB SATISFACTION AMONG DENTISTS

Compared to the physician, very little information exists on the incidence of psychosomatic disorders and the degree of job satisfaction dentists experience in their profession. Such information is of considerable importance both theoretically and practically in that such variables are generally considered to exert influences on the dentist's capacity as a provider of specific health services. In particular, there is little information on the military dentist who must function in a unique system which is quite different from that of his civilian counterpart. It is assumed that dentistry is a stressful profession and it may be further assumed that these stresses may be modified or intensified because of the demands of the military mission. Thus the purpose of the series of present studies is to begin to collect data on various factors which may impact on the capacity of the military dentist to render high quality dental care. In the current series of studies, data on job satisfaction, numbers of psychosomatic disorders, hobbies and leisure time use were collected from 900 dentists attending the annual meeting of the American Dental Association. In addition, blood samples were collected for analysis of specific enzymes believed to be indicative of depression, etc. The purpose of this collection of data was to provide baseline data with which to compare subsequent studies of career military dentists. Preliminary results indicate that dentists have a low incidence of psychosomatic disorders. However, there was a tendency to report greater frequencies of migraine headaches and difficulty sleeping

at night. The biochemical parameters are currently being submitted for computer analysis. These initial findings are particularly impressive in that they suggest that the stress of dentistry as a profession is not as great as has been hypothesized in previous reports. Additional analyses are also being performed on the data.

EVALUATION OF A MASTER'S DEGREE IN EDUCATION RELATED
TO MILITARY ADVANCED DENTAL TEACHING PROGRAM

This study has been designed to obtain and evaluate data from U.S. and Canadian dental schools related to master's degrees in education. A questionnaire is being sent to these schools in the hope that the data will define the importance of the degrees especially as they relate to accreditation standards of U.S. Army residency programs at the US Army Institute of Dental Research and elsewhere. The data will also help define the effectiveness of future master of education programs specifically designed for military dental educators. The questionnaires are in the process of being sent out to the recipients.

PUBLICATIONS

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6. Ayer, W.A.: Overview of the Behavioral Sciences in the Clinical Practice Areas, J. Dent. Educ., (In Press).
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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL ¹ ^{OL}	
				DA OD 6048	76 07 01	DD-DR&E(AR)636	
3. DATE PREV SUM ^{RY}	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8. DISB ⁿ INSTR ⁿ	9b. SPECIFIC DATA- CONTRACTOR ACCESS	9. LEVEL OF SUM
75 07 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES: ^a		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
a. PRIMARY		62110A		3A162110A825		00	
b. CONTRIBUTING						033	
c. CONTRIBUTING		CARDS 114(f)					
11. TITLE (Precede with Security Classification Code) ^a							
(U) Development and Evaluation of Nitinol for Use in Army Dentistry							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a							
009900 Metallurgy and Metallography							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
71 04		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (in thousands)	
b. NUMBER: ^a NA				FISCAL		76	
c. TYPE:				YEAR		7T	
d. AMOUNT:				CURRENT		2.0	
e. KIND OF AWARD:				77		1.0	
f. CUM. AMT.						55	
						9.7	
						41.1	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: ^a US Army Institute of Dental Research				NAME: ^a US Army Institute of Dental Research			
ADDRESS: ^a Washington, D.C. 20012				Division of Dental Materials			
				ADDRESS: ^a Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: ^a Huget, E.F., LTC, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3092			
				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
21. GENERAL USE				ASSOCIATE INVESTIGATORS			
				NAME:			
				NAME:			
Foreign Intelligence Considered							
22. KEYWORDS (Precede EACH with Security Classification Code)							
(U) Nitinol; (U) Compression Devices; (U) Fracture							
Fixation; (U) Oral-Facial Fractures.							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To exploit the shape memory phenomenon of 55-Nitinol for enhancement of the treatment capabilities of the Army dentist and physician. Realization of the conceptual uses of this unusual metal will result in substantial savings of laboratory costs and professional man-hours.							
24. (U) To design, fabricate, and test by means of animal and human studies, the following devices; (1) flexible wire clasps that will withstand accidental deformation out of the mouth, yet recover in the mouth; (2) prestressed surgical fixation staples and plates that will bend or contract slightly at body temperature, bringing bone fragments into close approximation or under slight compression; (3) self-anchoring fixation pins and endosseous implant devices; (4) collapsible devices for placement into defects (cyst cavity, cleft palate, etc.) through orifices smaller than the inside diameter; (5) fixed and removable prosthetic appliances, restorations or precision attachments that can move into undercuts in the mouth.							
25. (U) (75 07 - 76 06) The mechanical (shape) memory characteristic of nominally equiatomic Ni-Ti (Nitinol) wire has been exploited to design and to manufacture a series of compression devices for reduction, fixation and stabilization of osseous fractures. The devices have been calibrated to deliver compression forces that range from 484 grams to 625 grams. Presently, an animal protocol is being developed to test clinically the feasibility of the use of Nitinol in the management of combat inflicted oral-facial fractures.							

^a Available to contractors upon originator's approval.

DD FORM 1498
1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 68 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUM'Y 76 02 26	4. KIND OF SUMMARY D. CHANGE	5. SUMMARY SCTY* U	6. WORK SECURITY* U	7. REGRADING* NA	8. DISSEM INSTR* NL	9. SPECIFIC DATA - CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	10. LEVEL OF SUM A. WORK UNIT
10. NO./CODES*		PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER		
a. PRIMARY		62110A	3A162110A825	00	031		
b. CONTRIBUTING							
c. CONTRIBUTING		CARDS 114(f)					
11. TITLE (Precede with Security Classification Code)* (U) Preventive Dentistry Measures of Military Significance							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 003500 Clinical Medicine							
13. START DATE 71 01		14. ESTIMATED COMPLETION DATE CONT		15. FUNDING AGENCY DA		16. PERFORMANCE METHOD C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (in thousands)	
b. NUMBER: NA				FISCAL		76	
c. TYPE:				CURRENT		71	
d. AMOUNT:				YEAR		77	
e. KIND OF AWARD:				2.0		57.1	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Preventive Dentistry			
RESPONSIBLE INDIVIDUAL				ADDRESS: Washington, D.C. 20012			
NAME: Cutright, D.E., COL, DC				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
TELEPHONE: 202-576-3484				NAME: Katz, R., MAJ, DC			
21. GENERAL USE				TELEPHONE: 301-677-7451			
Foreign Intelligence Considered				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
22. KEYWORDS (Precede EACH with Security Classification Code)				ASSOCIATE INVESTIGATORS			
(U) Oral Health Evaluation; (U) Dento-Facial Injuries				NAME: Brady, J.M., COL, DC; Paquette, O. LTC			
(U) Toothbrush Effectiveness; (U) Cervical Erosion				NAME: DC; Grower, M., MAJ, DC			
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To develop new and simplified methods of preventing oral diseases and maxillo-facial injuries. To assess new methods of (1) improving the biologic management of militarily relevant oral conditions and (2) improving the cost-effectiveness factors of preventive dental therapy in the military.</p> <p>24. (U) Studies will be conducted on military installations which will evaluate (1) methods of prevention of militarily relevant oral abnormalities and maxillofacial injuries; (2) methods of improving preventive dentistry delivery systems; (3) methods of improving cost-benefit ratios concerning delivery of preventive dentistry as a consequence of military duty; and (4) investigate the various hazards involved in the Army dental health delivery system.</p> <p>25. (U) (76 02 - 76 06) A W.H.O. method of evaluating dental health was found to be useful to Army dentistry as a means of providing comparable oral health data on world-wide oral exams by noncalibrated dental personnel. A one year epidemiological survey of dento-facial injuries among Army personnel is in progress. A six month analysis has been completed. A study of 3 different experimental bristle configurations on a standard toothbrush indicated none were preferable to a presently available configuration. A simplified caries index was tested and found acceptable for Army use. A study of the PGE and AMP content of diseased human gingiva suggests that these parameters may be useful in determining a course of therapy. A study among dentists showed that cervical erosion is a common and difficult to treat problem. A dental instrument to facilitate mass dental care in the field has been devised and is being evaluated.</p>							

*Available to contractors upon originator's approval.

DD FORM 1498
1 MAR 68PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 68
AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

PREVENTIVE DENTISTRY MEASURES OF MILITARY
SIGNIFICANCE

AN ASSESSMENT OF THE W.H.O. DENTAL HEALTH EVALUATION, LEVEL
A SURVEY AS A MEASUREMENT FOR EVALUATING PROGRAMS FOR CARIES CONTROL

The purpose of this investigation was to determine whether the W.H.O. Dental Health Evaluation, Level A Survey (1967) meets the needs of the Army Dental Corps in evaluating the effectiveness of dental caries prevention programs conducted by the Army among military personnel. Specifically, the objectives were to determine (1) whether the W.H.O. Index accurately describes the dental caries experience of the Army population and (2) whether it is simple and efficient to observe, apply and record, and (3) to determine the degree to which the index demonstrates inter-examiner reliability.

A survey was conducted at Ft. Knox, Kentucky in 156 US Army active duty personnel ranging in age from 17-42 years. Each subject was independently examined and given a W.H.O. Caries Index score by two noncalibrated dentists (dentist A and dentist B); additionally, every subject was examined and given a DMFS Index score by dentist B following his W.H.O. examination. The internal validity of this index was tested by observing that the assumptions concerning cumulative membership were valid for 133 of the 156 subjects (85.3%). The external validity of the W.H.O. Index was tested by two methods: (1) observation of a parallel increase in mean DMFS score as severity of W.H.O. zone increased and (2) a Kendall's correlation between the individual subjects DMFS score and zone category of tau = 0.47. The interexaminer reliability test revealed a Spearman correlation of $r = 0.83$ with 80% of the subjects scored identically by both examiners. A 10% random sample that was recycled through the examinations demonstrated

intraexaminer reliability scores of 100% agreement for dentist A and 93.3% agreement for dentist B. The high inter and intrareliability scores combined with acceptable validity scores indicate that this index could be of use to the US Army Dental Corps by providing comparable data on world-wide oral examinations by noncalibrated dental personnel.

AN EPIDEMIOLOGICAL SURVEY OF ACCIDENTAL DENTO-FACIAL INJURIES
INCURRED AMONG ACTIVE DUTY ARMY PERSONNEL

The specific purposes of this study are (1) to determine the workload placed on the Army Dental Corps as a result of accidental dento-facial injuries occurring among active duty Army personnel; (2) to identify preventable and nonpreventable factors contributing to these accidental injuries; (3) to determine if (and if so, what) relationships exist between the military duties performed by the soldiers and these accidental injuries and (4) concerning these injuries, to determine if high-risk jobs exist in the Army; and if so, to determine if measures can be taken to decrease the risk of dental injuries among personnel performing these duties.

Epidemiological data is being collected concerning all aspects of factors involved in accidental dento-facial injuries. The study was initiated 1 September 1975 and is designed to run 12 months.

A six month analysis has been initiated with the following findings. A total of 413 cases were reported during the six month period yielding a projected overall accident rate of 39.2/10,000/yr. Adjusted accident rates for post types which exceeded the overall rate were 102.2/10,000 yr for Basic Training posts and 56.0/10,000/yr for MP Training posts. The

mean age of injury victims was 21.9 ± 4.9 years.

Fist fights were involved in 29% of the injuries, sports in 25% and weapons in 7%. Accident rates when analyzed for time of occurrence revealed a statistically significant increase in the afternoon and evening hours, but no difference for the days of the week. Bone fractures occurred in 23% of the injuries, tooth injuries in 61%, and soft tissue injuries requiring sutures in 35% of the cases. The study is continuing into the next fiscal year.

EVALUATION OF THE EFFECTS OF VARYING THE NUMBER AND DISTRIBUTION PATTERNS OF TOOTHBRUSH BRISTLES ON THE CLEANSING EFFICACY OF THE TOOTHBRUSH

The aim of the project was to determine the relative effectiveness of varying the number and distribution patterns of bristle tufts within the same model of a soft nylon bristled straight handled toothbrush. The criteria of effectiveness was the ability to remove plaque from the human dentition. The study consisted of two parts. In Part I, 130 adult subjects were divided into five groups in such a manner that the initial mean plaque scores of the groups were equal (based upon Quigley - Hein Index). Immediately following their initial plaque examination the subjects either brushed their teeth under professional supervision using a standard Bass technique and standard dentifrice for a period of 4.67 minutes, or served as controls according to the following schedule:

Group A (25 subjects) served as controls and did not brush.

Group B (27 subjects) brushed with a soft nylon bristled toothbrush having four rows of 12 tufts each - standard Oral B-40 toothbrush. This brush was coded E-14.

Group C (26 subjects) brushed with an identical type brush except

that it had four rows of bristles each containing six tufts - brush coded E-5.

Group D (26 subjects) brushed with the same type brush except that it had four rows of bristles and the outside rows contained six tufts and the inside rows contained nine tufts - brush coded E-6.

Group E (26 subjects) brushed with the same type brush except that it contained four rows of bristles with each row containing six tufts and the rows were staggered. Brush coded E-1. Immediately following the therapy (toothbrushing), all subjects were reexamined using the Quigley Hein Plaque Index. In Part II, 97 adult subjects were divided into four groups in such a manner that the initial mean plaque scores were equal. Immediately following their initial examinations, all subjects received a prophylaxis and scaling to remove all plaque. For a period of 28 days, the subjects conducted unsupervised toothbrushing using the following toothbrushes:

Group A (24 subjects) used the E-14 toothbrush

Group B (24 subjects) used the E-1 toothbrush

Group C (25 subjects) used the E-5 toothbrush

Group D (23 subjects) used the E-6 toothbrush

On Day 29 all subjects received a second plaque examination and were required to complete a questionnaire concerning the brushes they used. Results of this study indicated the following: (1) Supervised toothbrushing resulted in significantly more plaque being removed by the E-14 toothbrush (regular Oral B-40) than by any of the experimental toothbrushes. (2) Unsupervised toothbrushing resulted in slightly, but not significantly less plaque reformation following use of the E-14 toothbrush than any of the other brushes. The questionnaires revealed that the patients preferred

the regular Oral B-40 brush to any of the experimental brushes. Their preference of the Oral B-40 was based on their opinions as to cleansing ability and irritation to soft tissues when using the brushes. Conclusion: The Oral B-40 is probably preferable to the experimental brushes for use by troops.

EVALUATION OF THE INTEREXAMINER RELIABILITY
OF A SIMPLIFIED CARIES INDEX

The purpose of this study was to determine the level of interexaminer reliability of a simplified caries index for noncalibrated U.S. Army dentists. On day 1 of the study, seven U.S. Army dentists were introduced to a minimal set of rules for the scoring of this simplified caries index. No attempt was made to calibrate these dentists; specifically, they were instructed not to even discuss the index, its scoring or its uses, until after the completion of the study. On day 2, thirty-two subjects (all U.S. Army soldiers) were examined by the seven dentists in a round robin format, i.e. each examiner scored every subject on the simplified caries index. The examinations were conducted in standard dental operatories using standard dental lighting, mouth mirrors and explorers; no radiographs were taken. The data from 224 examinations were subjected to a Spearman's correlation analysis. The average (mean) correlation for the group of seven examiners on all 224 examinations was a Spearman coefficient of 0.72.

The next type of analysis performed on this data was a search for the frequency with which there was agreement among the examiners regarding the subjects. The findings show that for 16 subjects (50%) there was total agreement among the examiners, that for 4 subjects (12%) there was

agreement by 6 out of 7 examiners, that for 5 (16%) subjects there was agreement by 4 out of 7 examiners, and that for 1 (3%) subject there was agreement by only 3 out of 7 examiners. The subject whose ratings showed the greatest disagreement (i.e. only 3 out of 7 examiners in agreement) had two fractured anterior teeth which, judging by the scoring results, led to different decisions by the various examiners. Two other subjects with fractured incisor teeth also proved more likely to create disagreement among the examiners.

As a result of the percent agreement analysis, it is suggested that the minimal set of rules for the index include a statement clarifying the scoring of fractured teeth. The finding of an overall correlation of 0.72 under conditions of noncalibrated examiners which simulates the actual oral health data collection methods of the U.S. Army Dental Corps suggests that this simplified caries index is entirely applicable to the requirements of Army dentistry.

cAMP AND PGE CONTENT OF DISEASED HUMAN GINGIVA

The aim of this study was to determine the nature of the correlation between clinical evaluation of the gingiva and tissue levels of cAMP and prostablandin E (PGE) and alveolar bone loss. This was done to determine if the concentrations of cAMP and PGE, which appear to be involved in inflammation and wound healing, could be used as adjuncts in the evaluation of the extent of gingival pathology. In addition, knowledge of their dynamic interplay in gingival inflammation might allow the development of more effective therapy. Such therapeutic procedures would be of value to the Army in that they would reduce the need for skilled manpower and

result in cost savings and if effective could result in lowered loss of productivity by the soldier suffering from gingival pathology. The gingival cAMP content of eight patients with a gingival index (GI) of 1, who were used as the baseline to compare against further degrees of gingival inflammation, was 23.9 ± 3.1 picomoles/mg protein while the PGE content was 1.9 ± 0.3 nanograms/mg protein. Subjects with increased gingival inflammation based on increased cervical fluid and a GI of 2 showed a 160% increase ($p < 0.001$) in gingival PGE Levels along with a 38% decrease ($p < 0.05$) in cAMP content. During more severe gingival changes (GI 3,4) the PGE levels remain elevated, but as fibrosis occurs the cAMP levels approach or surpass those at GI 1. The changes seen in the cAMP and PGE levels of the gingiva thus do not exhibit a simple linear relationship as represented by the gingival index but instead exhibit a biphasic response which suggests that the interaction between the PGE and cAMP levels may play a role in the physiologic responses seen and should be a factor to consider in developing future therapeutic measures in the soldier population.

THE RELATION OF CERVICAL EROSION TO ORAL HYGIENE HABITS

The opportunity to obtain data on the extent of cervical erosion among dentists and their related oral hygiene habits presented itself at the 1975 ADA health screening survey. Evidence of cervical erosion in a group especially aware of this insidious disease provides an excellent baseline from which to judge the extent and difficulty of the problem as it may be encountered in military dental practice. The survey included 1087 dentists. Seventy percent of all the dentists surveyed brushed 2 to 3 times per day. Over 82 percent used nylon bristle brushes and the

toothbrushing techniques used included "Bass", by 29.8%, "Roll", by 19.2%, "scrub", by 12.1% and a combination of all three was used by 39.7%. Over 76% of the dentists used either crest or colgate toothpaste. The rest used other brands or homemade products. Two-thirds of the dentists surveyed received a prophylaxis at least once a year with flour of pumice used by 46.2% and zirconium silicate by 40.3%. Less than 20% of the dentists had either excessive grinding habits or excessive occlusal wear. Cervical erosion was reported by 28.6 of the respondent dentists. Of these, 20.1% believed themselves to have active lesions with 38.6% being able to stop the progress of the erosion, 18.5% unable to do so. Silicon impressions were made of most affected areas in 45 individuals or 14.7% of the 306 individuals indicating presence of the disease. Of these lesions, 39 (87%) were the characteristic sharp shape, indicating an active process, the remainder were of the rounded shape as described in the results of a previous survey. Scoring of the impressioned subjects indicated equal distribution of the lesions between right and left sides, although 93% of the subjects were right-handed.

These results further demonstrated the common occurrence of cervical erosion the cause of which is unknown. It is highly significant that even dentists who are acutely aware of cervical erosion should suffer the loss of hard dental tissue to the extent of 29% of individuals and unarrestable in 19%. This suggests that the problem is of sufficient proportions to warrant studies which will provide adequate anti-erosion agents and restorative methods for the cervical area.

A DENTAL INSTRUMENT COMBINING A CHIP BLOWER WITH VARIOUS EASILY
INTERCHANGEABLE TIPS: A DESIGN TO FACILITATE MASS DENTAL CARE
AND TO SIMPLIFY THE ARMAMENTARIUM FOR FIELD DENTISTRY

Military dentists can be called upon to provide mass dental examinations and to do dental treatment under circumstances demanding the utmost in efficiency with the help of only minimal resources. Instrumentation that caters to this need promises important benefits, especially in field practice.

Demand on the part of busy dental officers for some method of conveniently accomplishing routine drying and debris removal during procedures in the mouth appears to center around a combination dental explorer/chip blower which could also accommodate other instrument tips as appropriate and practical. Such an instrument would enable clinicians to swiftly inspect and instrumentate intraorally with a clarity, sureness, and precision possible only with a conveniently available, clear, dry field. Simple, practical instruments designed for such multiple functions will appreciably enhance the compactness and utilitarian efficiency of the dental field kit. A combination explorer/chip blower would be of particular value in mass dental examinations. By incorporating both functions in a single piece, both instruments come instantly to hand with reduced need for bothersome reaching or instrument passing. Additionally, an assistant need not be exclusively occupied at chairside in instrument passing and may pursue other important duties with less compromise to the doctor's efficiency. This is particularly significant in the military, where the doctor rarely has full control over the quality or even availability of personnel to assist at chairside. Such improvement in instrumentation would be of particular benefit in mass treatment/examination situations where seconds saved soon add up.

Most suitable for the purpose would be an instrument handle which would accommodate a variety of instrument tips that could be easily and quickly interchanged as needed. Tubing would direct the airflow to the area or point desired. Such an instrument seems both possible and practicable. A simple device has been produced proving the basic concept. An improved design has been developed and will be evaluated.

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL	
				DA OF 604C	76 07 01	DD-DR&E(AR)636	
3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8. DISSEM INSTN*	9. SPECIFIC DATA- CONTRACTOR ACCESS	
75 07 01	D. CHANGE	U	U	NA	NI	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES*		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
a. PRIMARY		62110A		3A162110A825		00	
b. CONTRIBUTING						111	
c. CONTRIBUTING		CARDS 114(f)					
11. TITLE (Precede with Security Classification Code)* (U) Application of Laser Technology to Maxillofacial Wound Debridement and Prosthetic Rehabilitation.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS*							
003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
74 06		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE: NA				PRECEDING		b. FUNDS (In thousands)	
b. NUMBER:*				FISCAL		76	
c. TYPE:				CURRENT		1	
d. AMOUNT:				77		18.8	
e. KIND OF AWARD:				1.0		78.9	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Pathology			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Adrian, J.C., COL, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3258			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Brady, J.M., COL, DC			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Laser Welding; (U) Glazed Enamel; (U) Alumina Implants; (U) Tricalcium Phosphate Ceramic; (U) Predentin Index.							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To determine the feasibility of the application of laser technology to prosthetic rehabilitation and to maxillofacial wound debridement and treatment. Utilization of this technology if proven successful could save precious metal costs of up to \$1,000,000 per year.</p> <p>24. (U) Energy levels, methods of contour and approximation of pontics to establish optimum weld patterns and strengths will be investigated. This will be accomplished first in a bench set-up and secondly in animals to establish feasibility and safety. To expand the capability via the continuous wave carbon dioxide laser for use in maxillofacial surgery. A comparison of healing of laser vs present surgical techniques will be evaluated for speed, esthetic results, secondary infectious complications, blood loss and ease of use.</p> <p>25. (U) (75 07 - 76 06) Studies are in progress to determine effectiveness of surface "glazing" in preventing sub-surface enamel demineralization. In studying laser effects on dental pulp a "predentin index" has been developed which appears to be an excellent objective index of pulpal trauma. Successful in-vivo laser welding of full crown preparation on incisors teeth in monkeys demonstrated the feasibility of this method. Laser welding has been used to attach tricalcium phosphate ceramic to the surface of an alumina tooth implant with the intention of stimulating new bone that would not otherwise form around the alumina implant. Bone is known to form on a tricalcium phosphate surface. If successful, the tricalcium phosphate coated implant may completely duplicate a normal functioning dental root.</p>							

*Available to contractors upon originator's approval.

DD FORM 1498

1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORM 1498A, 1 NOV 68 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

THE APPLICATION OF LASER TECHNOLOGY TO MILITARY DENTISTRY

LASER EFFECTS ON ORAL TISSUES

Studies on the use of the laser to prevent sub-surface demineralization by "glazing" the surface of enamel are continuing. Several different pulse widths and energy densities have been tested. Utilizing the scanning electron microscope (SEM) it has been observed that with the Nd laser, the energy density necessary to appropriately alter the enamel surface is very close to that required with a CO₂ laser. This amount of energy is 29 Joules/cm.² Energy densities of 592, 962 and 1178 Joules/cm.² were also examined. At all the above energy levels the enamel was grossly altered. The SEM at its higher energy levels demonstrated a markedly roughed and cracked surface which appeared to be the result of melted and refused enamel. Deep Fissures were also present. In addition, the altered material did not appear to be firmly attached at the interface with the underlying unmodified enamel.

In studying the effects of laser radiation on the dental pulp it was observed that the predentin layer in the area of insult was different quantitatively from that observed in other areas of the pulp chamber. A thickness measurement of the changed and unchanged areas and their comparison in the form of a ratio forms the basis of a predentin index which appears to be an excellent objective indicator of pulpal trauma. All previous methods of evaluating pulpal trauma have been essentially subjective. Since predentin is a product whose formation is mediated by the odontoblast, any injury to this highly sophisticated cell will result in a decrease in the thickness of the associated predentin layer. A comparison of predentin indices for experimental teeth subjected to

laser radiation versus unexposed control teeth produced highly significant differences which indicate that this new method is a highly reliable indicator of pulp injury. Further application of this method are currently being investigated for use in soldiers.

LASER WELDING OF BASE METAL ALLOYS

Previous work in our laboratory has shown that laser welding of base metal alloys is feasible and that clinical usage of such materials is possible. Since further study has shown that the dental pulp is less susceptible to neodymium laser radiation than to ruby laser radiation an in-vivo study of neodymium laser welding in monkeys is in progress. Full crown preparations of maxillary incisor teeth of a monkey were made. The four gold crowns were inserted. Two of the crowns (maxillary right lateral and central incisors) were laser welded together on the cast before insertion in order to serve as controls. The remaining two incisors on the left side were inserted and welded together in-vivo. After five days, a period suggested for development of an inflammatory response in the pulp, all four teeth were removed and examined histologically. There was no significant difference between the control and experimental teeth. This suggests that in-vivo laser welding is feasible. Additional samples will be welded and studied.

SCANNING MICROSCOPY AND ENERGY DISPERSIVE X-RAY ANALYSIS OF LASER-FUSED ALUMINA SURFACES

Scanning microscopy of functional cemental surfaces - the surface of functional collagenous attachment, is marked by calcification fronts proceeding along perpendicularly oriented collagenous bundles of the

periodontal ligament. Previous research has shown that new bone is formed directly against tricalcium phosphate ceramic, with no collagenous interface. Alumina tooth implants in military dental applications are acceptable but no collagenous union occurs. Initial investigation is being conducted to see if tricalcium phosphate ceramic can be laser welded to alumina and then to determine if this type of ceramic will initiate new bone formation at its surface. The end result will be an alumina tooth implant with regions of spot-welded ceramic with a bony coating; an imitation of a root surface of a tooth. It is postulated that if this implant is placed at first rigidly in the bone site, bone formation will begin on its surface. Then, after a to be determined interval, if the implant is put into function, bony union with the lost bone will be prevented, and after a time for reorganization of the periodontal ligament space a functioning bone surface will be present on the root surface of the implant. The end result will be an almost complete duplication of the normal functioning dental root.

Laser welding of 2 mm thick alumina slabs, cut with a diamond wheel, were coated with powdered tricalcium phosphate ceramic, cycled to 2020°F, slow-cooled, and exposed to the pulse of a neodymium laser. SEM and electron probe analysis showed regions of molten ceramic around a central core of bare molten alumina, resisting abrasion with scalpel blades. Additionally, small 2 mm wide cylinder blocks of tricalcium phosphate ceramic were laser treated on all surfaces and deposited in rat tibias for 5 weeks. SEM and elemental analysis indicate tissue acceptance of these implants. The bone ceramic interface is being studied presently for location of new bone formation.

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
75 07 01	D. CHANGE	U	U	NA	ML	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO. / CODES*	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER	WORK UNIT NUMBER		
a. PRIMARY	62110A	3A162110A825		00	119		
b. CONTRIBUTING							
c. CONTRIBUTING	CARDS 114(F)						
11. TITLE (Precede with Security Classification Code)*							
(U) Development and Evaluation of Dental Materials and Materiel for Army Use.							
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010300 Miscellaneous Materials							
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69 01		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (In thousands)	
b. NUMBER: NA				FISCAL		76	
c. TYPE:				CURRENT		77	
d. KIND OF AWARD:				77		2.5	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Dental Materials			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Huget, E.F., LTC, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3092			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
22. KEYWORDS (Precede EACH with Security Classification Code)				NAME: Hertert, R., 1LT, MSC; de Simon, L.;			
(U) Pulp Tester; (U) Porcelain-Base Metal; (U) Electroless				NAME: Woody, R.D., LTC, DC			
Plating; (U) Dental Material Toxicity; (U) Denture Fabrication; (U) Dental Instruments.							
23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) To evaluate new materials and materiel of special interest to the Army dentist. Criteria for selection of materials, devices or techniques for evaluation are based on anticipated high potentials for: (1) savings of fiscal and/or manpower resources; (2) work simplification; (3) improved health care delivery in combat areas; and (4) enhanced safety with respect to professional and ancillary personnel as well as to the patient.</p> <p>24. (U) New materials will be evaluated on the basis of the following parameters; Composition, microstructure, physical and mechanical properties, cytotoxicity, and clinical performance.</p> <p>25. (U) (75 07 - 76 06) Three new high-copper amalgam alloys have been evaluated and found superior to amalgam alloys currently used in Army dental clinics. Clinical testing of a USAIDR developed pulp tester continues with good results. A new method of precoating base metal prior to fusing on porcelain has been developed which should markedly enhance the usefulness of base metal alloys in Army dentistry. Continued testing of electroless plating for treating occlusal surfaces of teeth indicates its high potential as a decay preventive. The cytotoxic potential of 4 base metal alloys was tested in tissue culture. Only one did not reveal toxic effects. An analysis of removable partial denture fabrication techniques in relation to clinical fit is in progress. A universally applicable method for dental instrument sharpening has been developed and tested. An improved instrument for precision placement of self-hardening liquid bases has been developed and clinically tested.</p>							

* Available to contractors upon originator's approval.

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PII Redacted

DEVELOPMENT AND EVALUATION OF DENTAL MATERIALS
FOR ARMY USE

LABORATORY EVALUATION OF "HIGH-COPPER" AMALGAM ALLOYS

Several new dental amalgam alloys containing relatively large amounts of copper have become items of commerce since the first version of a dispersed system (Dispersalloy, Johnson & Johnson) was introduced 13 years ago. Experience has shown that the initial high-copper alloy exhibits exceptional early strength properties and low static creep. Hence, the service life of restorations fabricated from this material is markedly superior to the service life of restorations made from conventional amalgam alloys. During the past year, a number of competitive high-copper alloys have become available. The present task was initiated to determine the suitability of these materials for use in Army dentistry. Laboratory evaluation of 3 new high-copper alloys (Optalloy II, L.D. Caulk; Tytin, S.S. White; and Aristaloy CR, Engelhard) has been completed. These materials exhibit greater early strength, less flow and significantly lower static creep than the amalgam alloys used routinely in Army dental clinics. The material evaluated to date merit consideration for procurement through routine federal channels.

DESIGN AND DEVELOPMENT OF NEW INSTRUMENTATION FOR
THE DETERMINATION OF PULP VITALITY

Prototype instrumentation that employs visible light for assessment of pulp vitality was tested clinically. Problems of insufficient mechanical stability and of extraneous electrical interferences have been alleviated through the use of signal averaging techniques. Further improvement of the diagnostic device has been achieved through redesign of the

electronic circuitry.

Animal experiments have established that the signal obtained from the vital dental pulp organ is independent of the wavelength of the transilluminating light. The data further suggest that the observed signal is a function of blood pressure and flow velocity rather than of pulsatile changes in oxygen saturation.

It is anticipated that the eventual application of this diagnostic system to military clinical practice will preclude the use of unreliable electric-shock testing and the evaluation of pulp vitality based upon response to "hot" and "cold" stimuli. The diagnostic capability of the Army dentist will be augmented and the definitive treatment of numerous problem cases expedited.

DETERMINATION OF THE APPARENT BOND STRENGTH OF BASE METAL-PORCELAIN COMBINATIONS

Studies conducted over the past 2 years have shown that bonding of porcelain to base-metal crowns and bridges is technique sensitive. Thick oxide-layers that form at the porcelain-metal interface during the fusion process further complicate the veneering procedure. We have demonstrated for the first time that high-temperature oxidation of the metal-substrate surface can be prevented by precoating of the metal with aluminum. Test specimens fabricated from aluminum coated base metals have yielded apparent bond strength values comparable to those obtained with precious metal-porcelain combinations. Recently, the direction of this task was altered to develop simple and reliable procedures for the production coating of base metal alloys to which porcelain can be fused.

It is anticipated that the development of this relatively simple coating procedure for base metal substrates will enhance markedly the usefulness of relatively inexpensive casting alloys in Army dentistry.

EVALUATION OF ELECTROLESS PLATING OF METALS ON TOOTH STRUCTURE

Eighteen-month data and observations resulting from the electroless deposition of silver and gold upon the occlusal surfaces of the teeth of primates have been encouraging. Coated pits and fissures of both maxillary and mandibular teeth have remained stable. Loss of the deposited metals appeared to occur primarily at loci of excessive occlusal function. The ability of precipitated silver to form a barrier to oral fluids was demonstrated by autoradiographic techniques. In vitro determination of the loss of radioactive precipitated silver from treated molar teeth submerged in physiological saline indicates that there is an initial loss of up to 8 percent of the deposited metal within the first 5 days after deposition. The deposited metal then stabilized with very small losses over a period of months. The findings to date, indicate high potential for the use of electroless plating procedures in the US Army Preventive Dentistry Program. The average soldier on entrance into the service has an average of seven tooth areas at risk to decay. Electroless plating of pits and fissures could significantly lower this projection. In addition the simplicity and speed of application of electroless plating would give it a unique value to the military. In response to a call for combat readiness relatively large numbers of soldiers could be effectively treated in far less

time than is now possible.

ASSESSMENT OF THE TOXICITY OF RESTORATIVE DENTAL MATERIALS BY TISSUE CULTURE TECHNIQUES

The cytotoxic potentials of three nickel-chromium based alloys (Ticonium 100, Gemini II and Victory) and an iron-chromium alloy (Dentillium CB) were assessed. In tissue culture, castings of all four test materials and powders composed of the corrosion products of Dentillium CB did not elicit adverse cellular changes. However, cultures containing powdered derivatives of the corrosion and wear products of the nickel-chromium alloys showed prominent zones of lysis and cell alteration. Responses to Victory were more severe than those to Ticonium 100 and Gemini II. In contrast to the behavior of iron-chromium powder derived from Dentillium CB, it would appear that powders of Ticonium 100, Gemini II and Victory readily release toxic ions. Beryllium, a potentially toxic element, is known to be a constituent of Ticonium 100 and of Gemini II. On the other hand, beryllium is not a constituent of Victory. Other compositional features of the test materials implicate nickel in the production of adverse cellular reactions. The clinical significance of the findings, at the present time, is not clear. Work will continue to establish criteria for the definitive assessment of the cytotoxic potential of base metal casting alloys available for use in Army Dentistry.

TISSUE RESPONSE TO BASE-METAL DENTAL ALLOYS

Four non-precious alloys, two of which contained beryllium, were implanted in the subcutaneous tissue of rats. Subsequent sacrifice times

ranged from 3 days to 1 year. Histologic evaluation of the soft tissue was made without knowledge of the alloy involved. On the basis of these observations, it was not possible to discern any difference between the reaction of the tissues to the metal discs. The presence or absence of beryllium did not appear, even after 1 year, to have any appreciable influence on the character of the tissue response.

CLINICAL COMPARISON OF REMOVABLE PARTIAL DENTURE FRAMEWORK
FABRICATED BY "HIGH-HEAT" AND "LOW-HEAT" LABORATORY TECHNIQUES

Approximately 60 percent of the recipients of removable partial denture service willfully discard their appliances. Generally, patient dissatisfaction develops prior to a post-prosthesis-insertion time of two years. The high incidence of appliance abandonment is attributed to discomfort and frank pain elicited by the destructive forces of ill-fitting cast frameworks which act upon the remaining natural teeth and supporting tissues.

Analysis of the problem suggests that patient dissatisfaction may have a sound iatrogenic basis.

This task was initiated to accomplish the following goals: (1) establish and define the parameters of apparent fit for cast removable partial denture frameworks; (2) compare the clinical-fit of castings made by two conventional techniques utilized presently by U.S. Army Regional Dental Laboratories; (3) determine for each technique and for each of two materials (Ticonium 100 and Vitallium-2), the amount of time required to achieve an acceptable "clinical fit". Accomplishment of the stated objectives will enhance the capability of the Army dentist to render high-quality prosthetic service and will result ultimately in substantial savings of manpower and fiscal resources. Thus far only 15 cases have been

done and data collection continues. No conclusions can be drawn from the work accomplished to date.

DECALCIFICATION CABINET FOR IMPROVING HISTOPATHOLOGIC TECHNIQUES

Preparation of osseous and dental specimens for microscopic slides presently requires a time consuming and cost ineffective technique for decalcification. A decalcification cabinet has been developed which virtually eliminates the problems associated with the previous techniques, is less time consuming and reduces slide preparation expense. A Federal Government patent application for this new device is pending.

A STUDY TO DETERMINE THE MOST EFFECTIVE AND EFFICIENT MATERIALS AND PROCEDURES FOR CLINICAL USE IN SHARPENING PERIODONTAL SCALERS AND CURETTES

Scaling and root planing are common procedures in military dental clinics, particularly in connection with the Army's stress on preventive dentistry. Because a convenient, effective approach to maintenance of the scaling/planing armamentarium is not in general use, and because military fiscal strictures often limit the number of instruments available, many service dentists are operating with well-worn, inefficient equipment. Those forced to serve in areas or situations in which professional equipment is at a premium are especially hard hit. Development of a satisfactory and universally practical approach to instrument sharpening will enable all military dentists to function at peak efficiency. An approach to sharpening, suitable for use in virtually any surrounding, has been developed. This is the first time that a universally applicable method for dental instrument sharpening has been developed, and made

available for application by the military dentist.

AN IMPROVED DENTAL INSTRUMENT FOR PRECISION PLACEMENT OF
SELF-HARDENING, LIQUID BASES

Self-hardening, liquid bases (Dycal, Cavitec, etc.) are routinely used in up-to-date dental practice. Proper technique requires that they be exactly placed and that any excess be carefully removed before the restoration is completed. There is presently no instrumentation that can be relied upon to accomplish this. Various instruments are pressed into service, some more effective than others, but none that are fully acceptable. The principal difficulty lies in placing the liquid material without having it run up the shank of the instrument by capillarity to contaminate areas that are often difficult to clean. The present design incorporates different sized, round pluggers having sharply rebated tips connected to a very thin shank. The sharp edge of the plugger tip discourages the effects of capillarity, and the thin shank prevents any such contamination from touching cavity walls. After hardening of the base, which remains relatively soft, the sharp edge of the plugger tip acts as a scraping instrument to effectively reach and remove any excess. In line with present efforts to condense and refine the field armamentarium, this instrument replaces several others and, at the same time, does a far better job of meeting the basic requirement. A prototype has been made and proven in clinical trials. Work is continuing.

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1. Cutright, D.E., Woody, R.D., O'Keefe, T.J. and Hoffman, J.I.: Caries Prevention by Electroless Deposition of Metals: A Preliminary Primate Study, J. of Prev. Dent., (In Press).
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4. Paquette, O.E. and Levin, M.P.: The Sharpening of Scaling Instruments I: An Examination of Principles, J. of Periodont., (In Press).
5. Paquette, O.E. and Levin, M.P.: The Sharpening of Scaling Instruments II. A Preferred Technique, J. of Periodont., (In Press).
6. Woody, R.D., Horton, J.E. and Huget, E.F.: Cytotoxicity of Base Metal Casting Alloys, J. Dent. Res. (Spec. Issue) 55 B #918, (1976).

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL	
				DA OG 6034	76 07 01	DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8. DISSEM INSTR	9. SPECIFIC DATA CONTRACTOR ACCESS	10. LEVEL OF SUM
75 07 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES *	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	62110A	3A162110A825		00		120	
b. CONTRIBUTING							
c. CONTRIBUTING	CARDS 114(f)						
11. TITLE (Precede with Security Classification Code)*							
(U) Development and Improvement of Metallic Restorative Materials							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS*							
009900 Metallurgy and Metallography							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
69 01		CONT		DA		C. IN-HOUSE	
17. CONTRACT GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (In thousands)	
b. NUMBER: NA				FISCAL		76	
c. TYPE:				CURRENT		0.5	
d. AMOUNT:				77		18.3	
e. KIND OF AWARD:				77		76.9	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Dental Materials			
RESPONSIBLE INDIVIDUAL				ADDRESS: Washington, D.C. 20012			
NAME: Cutright, D.E., COL, DC				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
TELEPHONE: 202-576-3484				NAME: Huget, E.F., LTC, DC			
				TELEPHONE: 202-576-3092			
				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
21. GENERAL USE				ASSOCIATE INVESTIGATORS			
Foreign Intelligence Considered				NAME: Cosner, H.E.; deSimon, L.			
22. KEYWORDS (Precede EACH with Security Classification Code)				NAME:			
(U) Dental Casting; (U) Base Metal Alloys; (U) Crown and Bridge Alloys; (U) Casting Accuracy.							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
<p>23. (U) Annual Army expenditures for previous metals utilized in the fabrication of fixed dental prostheses are in the vicinity of \$1,000,000. The cost of an equal volume of base metal alloy is \$30,000. Properties of base metal alloys indicates however, that these alloys cannot be utilized for small castings without drastic metallurgical modifications. This work is therefore being conducted to: (a) develop heat treatment methods for controlling properties of nickel-chromium based casting alloys; (b) evaluate nickel-chromium based alloys for use in operative dentistry.</p> <p>24. (U) The properties of nickel-chromium based alloys will be studied in details by various physical methods available in order to devise procedures which will optimize their usefulness. Any improvement obtained will be evaluated clinically.</p> <p>25. (U) (75 07 - 76 06) The shrinkage characteristics of 5 base metal crown and bridge alloys were determined (Ticon, Gemini II, Permabond, Ceramallo and Howmedica NP-2). Full crown restorations from these alloys displayed excessive shrinkage. Consideration of these alloys for Army use is not recommended. Four potential substitutes for gold casting alloys were evaluated. One contained beryllium (permabond) a potential hazard to laboratory workers, and 2 were excessively hard and brittle (AQ-70 and Ceramallo).</p>							

*Available to contractors upon originator's approval.

DD FORM 1498
1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 65 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

PUBLICATIONS

1. Huget, E.F., Dvivedi, N.N. and Cosner, H.E., Jr.: Characterization of Gold-Palladium-Silver and Palladium-Silver for Ceramic-Metal Restorations, J. Prosthet. Dent., (In Press).
2. Huget, E.F., Dvivedi, N.N. and Cosner, H.E.: Characterization of Economy Crown and Bridge Alloys, J.A.D.A., (In Press).
3. Huget, E.F., Dvivedi, N.N. and Cosner, H.E., Jr.: Characterization of Economy Crown and Bridge Alloys, J. Dent. Res. (Spec. Issue) 55 B #697, (1976).

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL	
				DA OH 6030	76 07 01	DD-DR&E(AR)635	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8. DISSEM INSTR*N	9a. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
76 02 26	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES*	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	62110A	3A62110A825		00		121	
b. CONTRIBUTING							
c. CONTRIBUTING	CARDS 114(f)						
11. TITLE (precede with Security Classification Code)*							
(U) Natural History of Oral Lesions Encountered in the Soldier							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS*							
003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
69 07		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
A. DATES/EFFECTIVE:				PRECEDING		b. FUNDS (in thousands)	
EXPIRATION:				FISCAL		76	
1. NUMBER: NA				CURRENT		0.5	
C. TYPE:				YEAR		5	
d. AMOUNT:				77		2.4	
e. KIND OF AWARD:				f. CUM. AMT.		0.5	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Pathology			
				ADDRESS: Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Adrian, J.C., COL, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3258			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Levin, M.P., COL, DC; Tsaknis, P., LTC,			
				NAME: DC; Payne, T.F., MAJ, DC. Esposito, J.			
22. KEYWORDS (Precede EACH with Security Classification Code) (U) Labial Frenum; (U) Temporomandibular Joint; (U) Maxillary Ameloblastoma; (U) Plaque Ph; (U) Occupational Hearing Loss.							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To recognize, characterize and develop effective therapeutic measures for those lesions and conditions which effect the soldier due to military duty. The recognition of environmental and other factors which participate in the etiology of lesions and conditions unique to the military or are causally related to military duty will enable the development of interceptive or therapeutic measures.							
24. (U) To detect through clinical and/or microscopic observation oral lesions or conditions unique to the military population. To identify oral lesions or conditions which, though not unique to the soldier, are etiologically related to the performance of duty. Once identified the natural history including etiology, therapy, and prognosis will be established utilizing appropriate methods such as surveys, animal, and human investigations.							
25. (U) (76 02 - 76 06) A study of the superior labial frenum indicated that elastic connective tissue fibers in the pathologic frenum, not muscles, is the cause of adverse effects on the supportive structures of the dentition. A study of oral health among dentists indicated a range from fair to excellent. A study of TMJ tumors indicated a malignancy rate of 50%. A study of maxillary ameloblastomas indicates that either surgical resection or hemimaxillectomy is the appropriate treatment. A study of radiation effects on the oral cavity indicates a distinct plaque pH drop which could be at least partly responsible for increased oral disease in these patients. Hearing loss as an occupational problem among dentists was found to be minimal. Additional hearing studies are recommended.							

*Available to contractors upon originator's approval

DD FORM 1498
1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 68 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE.

PII Redacted

NATURAL HISTORY OF ORAL LESIONS

HISTOLOGIC FEATURES OF THE SUPERIOR LABIAL FRENUM

Previous studies and traditional dental surgical literature indicates that surgical frenectomy should be performed to eliminate the striated skeletal muscle within the frenum which adversely affects the supportive structures of the dentition. Microscopic evaluation of human and autopsy specimens conclusively demonstrated, by means of muscle-specific histologic stains (Masson's trichrome and phosphotungstic acid hematoxylin) that striated skeletal muscle is not a normal component of the superior labial frenum. Destructive effects of the pathologic frenum are related to the effects caused by the overabundant development of elastic connective tissue fibers within the frenum as demonstrated by special stains.

ORAL HEALTH OF DENTISTS: ANALYSIS OF PANORAMIC RADIOGRAPHIC SURVEY

This study conducted at the Annual American Dental Association meeting represents the first report of an international sampling of the oral health status of dentists. The data collected will serve as a baseline for the determination and comparison of the oral health of the military population. One thousand two hundred and thirty-nine panographs were evaluated. No radiographic evidence of malignancy was noted: The incidencies of observed pathosis were classified and tabulated in the following categories.

- a. Missing teeth - 8,516 - 56.3% of the total were maxillary and mandibular third molars.

- b. Impactions - 495 - 96.5% were maxillary and mandibular third molars.
- c. Root tips retained - 8.
- d. Endodontic procedures - 1049 - 33.9% of dentists were in this category.
- e. Periodontal disease - 25.5% of dentists had radiographic evidence of bone loss.
- f. Carious lesions - 112 individual cases had readily apparent cavitation.
- g. Foreign bodies - 10 examples all of which resembled amalgam fragments.
- h. Miscellaneous Findings - 27 maxillary sinus mucocèles, 6 Stafnes bone cysts, 6 elongated stylo-hyoid processes, 2 soft tissue calcifications, 1 sinusitis, 1 incomplete mandibular fracture repair.

The overall dental health of participating dentists ranged from fair to excellent.

TEMPOROMANDIBULAR JOINT TUMOR STUDY

This project was undertaken to classify and describe the tumors accessioned by the AFIP which were primary to the TMJ. Approximately 10 tumors were found making it the largest single study of this nature.

A breakdown of these tumors of the TMJ indicates that 50% (5) are malignant and the remainder benign. Three of the malignant tumors were chondrosarcomas, one was a synovial sarcoma and the last was a bizarre fibrosarcoma. Of particular interest in the benign category was a peculiar giant cell component found in 3 tumors which defies previous diagnostic

classification.

Approximately six additional cases were analyzed and determined to be benign hyperplasias of the condyloid process of the mandible.

TREATMENT OF THE MAXILLARY AMELOBLASTOMA

This neoplasm, which is the most commonly occurring of the odontogenic tumors, presents with unusual characteristics when appearing in the maxilla as opposed to the mandible. Twenty-four cases were analyzed which indicate that the surgeon perform either a surgical resection of the tumor or a hemimaxillectomy. Surgical curettage invariably leads to recurrence of the tumor with subsequent complications requiring additional aggressive surgery. Primary or recurrent lesions locally invade into vital anatomical regions. Two patients in this study died because of eventual pituitary gland involvement by recurrent maxillary ameloblastomas.

CLEAR CELL SARCOMA OF TENDONS AND APONEUROSES

The first case report of this unique clinico-pathologic entity involving the oral structures has been identified. The biological behavior of this lesion which originated on the dorsum of the foot of a 19 year old female and metastasized to the oral regions indicates the unrelenting nature of this malignancy. Patient required continuous surveillance and extensive dental supportive care.

PLAQUE PH MEASUREMENTS

Xerostomia experienced by patients treated with therapeutic doses of radiation to the head and neck region, often leads to severe oral health

problems. Loss of teeth is one of the consequences. The purpose of this preliminary study was to follow the supragingival pH changes and relate them to the radiation treatment. Supragingival plaque pH measurement were made on 5 patients before and during radiation treatment. These patients received between 6000 and 6200 rads of ionizing radiation. Plaque pH was measured on non-carious buccal tooth surface using an antimony electrode. A standard calomel electrode served as the reference electrode. A comparison of the four quadrants gave the following mean pH differences between pre and ongoing radiation treatments: right maxillary - 0.67, right mandibular - 0.74, left maxillary - 0.55 and left mandibular - 0.70. Preliminary studies indicate that there is a change (a decrease in supragingival pH) during radiation treatment and this could be used as a clinical guide for studying the loss of teeth as a consequence of radiation treatment, the effects of Sjogrens Syndrome and Xerostomia.

HEARING AS AN OCCUPATIONAL PROBLEM AMONG DENTISTS

At the 1975 ADA convention data on acoustics and hearing medical history was obtained for 1216 practicing dentists. This study provided the opportunity to determine on a relatively large scale occupational hearing problems experienced by the dentist and thereby shed some light on the nature and extent of the problem that might exist among military dentists.

The largest group of dentists (76.5%) tested normal. A second group (11.5%) exhibited a normal age connected hearing loss. A third group (4%) tested abnormal but had known auditory pathology which was not work connected. Of the remaining 8 percent, one-half demonstrated the classic noise notch i.e. hearing loss due to noise exposure and the

other half showed hearing loss that fell between the classic noise notch and aging patterns.

A statistical evaluation of the results revealed the following: (1) a statistically significant greater percentage of subjects categorized as Noise Notch and Multiple Factors participated in target shooting and power tool use; (2) a statistically significant greater percentage of subjects with Known Pathology, Aging loss patterns and Multiple Factors reported having hearing difficulty; and (3) a statistically significant greater percentage of subjects classified as Known Pathology and Aging patterns reported that they did not use air turbines in their offices. The other data in the analysis showed no significant differences or trends.

While precise interpretations are not possible due to the relatively gross level of data collection (multiphasic health screening) the following general statements can be made: (1) there seemed to be some additional avocational noise exposure among the two groups which showed either classical noise hearing loss (Noise Notch Group) or Multiple Factors (combining aspects of noise induces loss and aging patterns loss); (2) lower usage of air turbines appeared in two groups which probably reflects their greater ages and hence a generation gap in equipment; and (3) the reporting of an awareness of a hearing loss was statistically significantly higher in those groups (Known Pathology, Aging, and Multiple Factors) for which the recorded loss occurred in the normal conversational range of hearing.

Although the findings are not U.S. Army specific nor conclusive regarding their implications, they are in agreement with the general trends emerging in the literature. As such they are supportive of the following recommendations which are proposed to fulfill the public

health responsibility of a conscientious employer such as the U.S. Army and to follow up on recent tests in a large Army dental clinic which revealed readings far in excess of published safe noise level guidelines.

1. A study be conducted to determine the noise levels in U.S. Army dental operatories and laboratories.
2. A separate study be conducted to determine the prevalence and severity of hearing loss amongst U.S. Army dentists, chairside auxiliaries and laboratory technicians.

This two pronged attack will evaluate both the potential occupational health hazard (by monitoring existing noise levels) and the current occupationally related disease levels (by audiometry testing of personnel). While the major interest will lie in assessing the noise levels and their related disease levels, there is documentation that high noise levels effects other physiologic functions (e.g. hypertension and pulse rate). A thorough literature search will be conducted to see the pertinence and feasibility of incorporating the collection of other physiologic data in relation to noise levels.

PUBLICATIONS

1. Adrian, J.C., Tsaknis, P.G. and German, N.I.: Surgical Oral Pathology in an Army Regional Laboratory: A Survey, *Mil. Med.*, 141:82-83, (1976).
2. Allen, P.M., Black, J.D., Toth, B.B., McFarland, P.H., Hinds, E.C. and Getter, L.: Clinical Pathological Conference, *J. Oral Surg.*, 34:257-259, (1976).
3. Henry, S., Levin, M.P. and Tsaknis, P.G.: Histologic Features of the Superior Labial Frenum, *J. Periodont.*, 47:25-28, (1976).
4. Payne, T.F. and Tsaknis, P.G.: An Evaluation of the Rinse Technique for Oral Cytologic Diagnosis, *Oral Surg.*, 40:382, (1975).

5. Payne, T.F.: An Evaluation of Actinic Blocking Agents for the Protection of Lip Mucosa, *J. Amer. Dent. Assn.*, 29:409-411, (1976).
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7. Tsaknis, P.G. and Carpenter, W.M.: Pathology Related to Impacted Teeth, *J. Acad. Gen. Dent.*, 23:36, (1976).
8. Tsaknis, P.G. and Payne, T.F.: Forensic Dentistry and the Military Police, *J. Mil. Pol. Law Enforcement*, 11:26, (1975).
9. Woodruff, H.C., Levin, M.P. and Brady, J.M.: The Effects of Two Ultrasonic Instruments on Root Surfaces, *J. Periodont.*, 46(2):119-126, (1975).
10. Adrian, J.C., Huget, E.F.: Tissue Response to Base-Metal Dental Alloys, *Mil. Med.*, (In Press).
11. Carpenter, W.M., Grower, M.F. and Nash, G.: Histocompatibility of Polyvinyl Acetate; An Ingredient of Chewing Gum, *Oral Surg.*, (In Press).
12. Carpenter, W.M., Tsaknis, P.G., Logan, W.J. and Konzelman, J.L.: Clear Cell Sarcoma of Tendons and Aponeuroses: Review of the Literature and a Case Report of Oral Metastasis, *Oral Surg.*, (In Press).
13. Levin, M.P., Cutright, D.E., Getter, L. and Manne, M.S.: The Effects of Surgery Time on Healing of Flaps, *J. of Clin. Periodont.*, (In Press).
14. Levin, M.P. and Cutright, D.E.: The Retrocuspid Papilla: Hypothesis of Origin, *J. of Periodont.*, (In Press).
15. Nelson, J.F. and Tsaknis, P.G.: Pathology of the Hard and Soft Palate, *J. of Prost. Dent.*, (In Press).
16. Nelson, J.F., Berringer, R.D. and Theissen, F.C.: Fibrous Dysplasia of the Mandible and Sphenoid Bones - A Case Report, *Oral Surg.*, (In Press).
17. Payne, T.F. and Lux, V.J.: An Evaluation of Commercial Decalcifying Agents, *J. Oral Path.*, (In Press).
18. Stanford, H.G. and Mueller, B.H.: A Technique of Management of the Unerrupted Maxillary Incisor, *J. Acad. of Gen. Dent.*, (In Press).
19. Stanford, T.W., Levin, M.P. and Payne, T.F.: A Comparison of the Mucogingival Junction in Dentulous and Edentulous Areas, *J. of Periodont.*, (In Press).

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV SUMRY 76 02 26	4. KIND OF SUMMARY D. CHANGE	5. SUMMARY SCTY ^a U	6. WORK SECURITY ^a U	7. REGRADING ^a NA	8A. DISSEM INSTR ^a NL	8B. SPECIFIC DATA - CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES: ^a	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	62110A	3A162110A825		00		115	
b. CONTRIBUTING							
c. CONTRIBUTING	CARDS 114 (f)						
11. TITLE (Precede with security Classification Code) ^a (U) Role of Pressurized Water Lavage in the Practice of Military Dentistry							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a 003500 Clinical Medicine							
13. START DATE 69 01		14. ESTIMATED COMPLETION DATE CONT		15. FUNDING AGENCY DA		16. PERFORMANCE METHOD C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE: NA				PRECEDING			
b. NUMBER: ^a				FISCAL YEAR		c. FUNDS (in thousands)	
c. TYPE:				76		1.5	
d. AMOUNT:				71		4	
e. KIND OF AWARD:				77		0.5	
f. CUM. AMT.						16.6	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Basic Sciences			
RESPONSIBLE INDIVIDUAL				ADDRESS: Washington, D.C. 20012			
NAME: Cutright, D.E., COL, DC				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
TELEPHONE: 202-576-3484				NAME: Gross, A., COL, DC			
				TELEPHONE: 202-576-3764			
				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
21. GENERAL USE				ASSOCIATE INVESTIGATORS			
Foreign Intelligence Considered				NAME: Jordi, H.C., CPT, MSC			
				NAME:			
22. KEYWORDS (Precede EACH with Security Classification Code) ^a (U) Water Lavage; (U) Surgical Scrub; (U) Pulse Pressure Lavage; (U) Bacterial Contamination; (U) Hand Lipids.							
23. TECHNICAL OBJECTIVE, ^a 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To determine the efficacy and application of pressurized water lavage to the treatment and prevention of disease in traumatic wounds, oral maxillofacial surgery and military dentistry.							
24. (U) Specially designed instruments which yield water jets at different pressures and in both pulsating and nonpulsating streams are being used to study the effect of this modality on wound healing, dental plaque, and bacterial populations. The target tissue pressures with various water jet devices will be examined. The applicability to presurgical hand cleansing is being investigated.							
25. (U) (76 02 - 76 06) The arm and hand washer constructed by USAMBRDL according to USAIDR specifications has been tested in actual use by surgical personnel on the OB Ward of the Walter Reed Army Medical Center. Arms and hands were washed with dilute betadine solution for 90 seconds at 120 psi and 1200 pulses/min. The results were compared with a 10 min. standard hand scrub by the same personnel. The 90 second pulse pressure lavage reduced hand and arm bacterial counts by 96.75% as compared to 90.74% for the standard 10 min. hand scrub. A study is in progress to determine hand lipid profiles in relation to hand bacterial counts. There is evidence that there is a hand lipid pattern which holds down hand bacterial counts.							

^a Available to contractors upon originator's approval.

ROLE OF PRESSURIZED WATER LAVAGE IN DENTISTRY

DESIGN AND TESTING OF NEW HAND LAVAGE UNITS

The Arm and Hand Washer manufactured by USAMBRDL according to USAIDR specifications has been evaluated previously for its effectiveness in pre-surgical preparation of hands of nonsurgical personnel. It has been shown to be very rapid, nonirritating and effective.

The device has been installed on the OB Ward of Walter Reed Army Medical Center and tested for its effectiveness on surgical personnel consisting of residents, interns and staff of the department of OB/GYN. With this device both arms and hands have been washed with betadine solution (253 x diluted) for 90 seconds at 120 psi and 1200 pulsation per minute. In addition the effectiveness of a standard 10 minute presurgical brush scrub utilizing betadine scrub, performed in the hospital scrub room just prior to major surgery, was evaluated on the same subjects.

Lavage of hands with the Arm and Hand Washer resulted in 96.75 percent reduction of bacterial counts with an average post lavage count for each hand of 3.8 colony forming units.

Evaluation of a standard 10 minute brush scrub has shown that a mean prescrub bacterial count of 85.5 was reduced by 90.74 percent to an average of 7.9 colony forming units per hand.

The comparison of the results obtained for two methods of presurgical preparation of hands clearly indicates that 90 seconds jet lavage is more effective than 10 minutes standard brush scrub. Additional advantages of the new method is the amount of time saved, the standardization of cleansing and the decrease irritation to the skin.

FATTY ACID CONTENT OF THE HANDS IN RELATION TO BACTERIAL CONTAMINATION

It has been found that certain individuals have higher bacterial levels on their hands than others. This has been noted even after washing in the hand lavage unit developed at the U.S. Army Institute of Dental Research. A study is in progress of the lipid compositions on the hands of people who have high versus those who have low bacterial levels. The purpose of this study is to determine if a key lipid or pattern of lipids can be found that might hold down hand bacterial levels in some people.

In order to determine the fatty acid levels on the hands a high performance liquid chromatographic (HPLC) method for the assay of lipids has been developed. The HPLC of various $C_2 - C_{24}$ fatty acids were run as their p-bromophenacyl, p-nitrophenacyl, p-chlorophenacyl, and 2-naphtacyl esters. All separations were accomplished using Y-Bondapak C_{18} reversed phase columns from Waters Associates with the eluent consisting of acetonitrile: water gradients. For all derivatives tested the separations were analogous and excellent although a few esters did elute together as a single peak. Quantitative results indicated that the limit of detection of the method was two picograms of n-caproic acid and 10 picograms of arachidonic acid as their p-bromophenacyl esters.

Methodology has also been developed for the extraction of lipids from the hands for subsequent determination by HPLC.

The methods developed for this study are now being applied to the assay of hand lipids from a number of individuals. The immediate objective is to correlate the absence or presence of bacteria with certain fatty acids. This would in turn enable us to rapidly identify those individuals with high

bacterial levels and perhaps hold the levels down by the judicious use of a hand wash containing bacteriostatic or bactericidal fatty acid(s), or discover or develop specific agents for use in these people.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION ^a	2. DATE OF SUMMARY ^a	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV. SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SCTY ^a	6. WORK SECURITY ^a	7. REGRADING ^a	8a. DISB'N INST'N	8b. SPECIFIC DATA- CONTRACTOR ACCESS	9. LEVEL OF SUM A. WORK UNIT
76 02 26	D. CHANGE	U	U	NA	NI.	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO./CODES: ^a		PROGRAM ELEMENT		PROJECT NUMBER		TASK AREA NUMBER	
a. PRIMARY		62110A		3A162110A825		00	
b. CONTRIBUTING						118	
c. CONTRIBUTING		CARDS 114(F)					
11. TITLE (Precede with Security Classification Code) ^a (U) New and Improved Techniques for Grafts and Bone Regeneration in Traumatic Wounds.							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS ^a 003500 Clinical Medicine							
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY		16. PERFORMANCE METHOD	
69 01		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
a. DATES/EFFECTIVE: NA				PRECEDING			
b. NUMBER: ^a				FISCAL YEAR		b. FUNDS (in thousands)	
c. TYPE:				76		1.5	
d. AMOUNT:				77		6.8	
e. KIND OF AWARD:				77		28.6	
19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Surgery			
				ADDRESS: Washington, D.C. 20012			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Stanford, H.G., COL, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 202-576-3080			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER: [REDACTED]			
				ASSOCIATE INVESTIGATORS			
				NAME: Cutright, D.E., COL, DC			
				NAME: Grower, M.F., MAJ, DC			
22. KEYWORDS (Precede EACH with Security Classification Code) ^a (U) Tricalcium Phosphate; (U) Osteogenesis; (U) Polylactic Acid; (U) Biodegradable Ceramic; (U) Biodegradable Polymer.							
23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To develop simple, rapid methods of soft tissue or bone grafting of particular interest to the oral surgeon treating combat type maxillofacial injuries.							
24. (U) The fate, metabolism, osteogenic potential and tissue compatibility of ceramic and copolymer materials will be studied alone and in combination. The application of these materials to avulsive type wounds in both animals and humans will be pursued.							
25. (U) (76 02 - 76 06) Study of the osteogenic potential of biodegradable tricalcium phosphate in humans continues to be promising. Twenty periodontal defects involving considerable bone loss have been treated thus far. No teeth have been lost due to disease. Reentry procedures have been done in 5 cases and remainder will be done in 12 to 18 months. The feasibility of restoring avulsed alveolar bone by using PLA as a template for remodeling has thus far given good results. A study of the ability of a collagen material to enhance the healing of osseous defects has been negative. A study is in progress to compare tricalcium phosphate and PLA as osteogenic agents.							

^a Available to contractors upon originator's approval

NEW AND IMPROVED TECHNIQUES FOR GRAFTS AND
BONE REGENERATION

OSTEOGENIC POTENTIAL OF DEGRADABLE CERAMICS IN PERIODONTAL
DEFECTS (HUMAN)

Presently the Institute is conducting a research project in which biodegradable tricalcium phosphate is being utilized in periodontal osseous defects of humans. Previous reports have related the excellent results in dogs and monkeys, where the ceramic material was found to be very well accepted biologically and, when placed in bony defects, allowed a new periodontium to form.

Thus far, twenty periodontal defects have been treated with the ceramic implant. Most of these were of an advanced nature with considerable bone loss involvement. Only one tooth has been extracted, and it was lost because of prosthetic requirements.

Reentry procedures have been done in five cases. Results indicate that at one year some ceramic is still present, and recommendations are for waiting at least eighteen months before reentering the area. Amount of bone fill varied from complete regeneration to none. In all cases the soft tissue approximating the ceramic implant appeared healthy. More information will be forthcoming shortly as several other reentries are scheduled in the near future.

If the project is successful, military dentists will have a bone implant material that is readily available, relatively inexpensive, pre-packaged, presterilized, and easy to use.

THE DEVELOPMENT AND EVALUATION OF THE ALVEOLAR GRAFT TECHNIQUE

During FY 76 an initial series of 24 graft procedures was performed on 6 dogs. The purpose of the study was to determine the feasibility of restoring avulsed segments of alveolar bone utilizing polylactic acid sheets as a template for the remodeling process so that the alveolar bone would return to its preinjury height. The results obtained 6 months postoperative demonstrated that the use of the polylactic acid template resulted in an increased height of alveolar bone as compared to the control sites. The use of the polylactic acid (PLA) did not, however, result in a return of the alveolar bone to its preoperative height. A consistent technical problem was breakdown of the overlying mucosa over the PLA template immediately postoperatively. The PLA exhibited excellent tissue compatibility with re-epithelization occurring at approximately 7 days with no evidence of postoperative infection. This study is continuing.

COLLAGEN GEL IN OSSEOUS DEFECTS

In a preliminary study, the effects of a biodegradable collagen gel on the healing of osseous defects were examined. Histologic and biochemical observations made on the seventh day following placement revealed that the collagen gel is well tolerated by the recipient and might be an effective stimulator of reparative bone formation. However, between the seventh and fourteenth day following placement, the deposition of reparative osseous tissues at the implant site was significantly retarded. Three suggested possible explanations for this phenomenon are the following:

1. Recognition by the host of the "foreign" collagen matrix.
2. Possible release of an inhibitor of osteogenesis from the re-constituted gel.

3. Destruction of the osteoid by cells involved in the degradation of the implant.

EVALUATION AND COMPARISON OF TRICALCIUM PHOSPHATE AND POLYGLYCOLIC ACID AS OSTEOGENIC AGENTS

In the continuing search for alloplasts in bone grafting procedure these two compounds, which have shown promise in previous experiments, were implanted individually and in combination in the tibial shafts of adult rats. The purpose of the study was (1) to compare osteogenic potential of the two materials (2) to evaluate possible synergism when materials are combined as a single implant (3) to act as a preliminary study and precursor to similar experiments in large discontinuity and space defects in large primates. We are presently now half way into the study and results are not yet available.

PUBLICATIONS

1. Brady, J.M. and Cutright, D.E.: Electron Microscopy of Osteo-Genesis in Ceramic Implantation, J. of Biomedical Res., (In Press).
2. Grower, M.F., Cutright, D.E., Selting, W.J. and Getter, L.: Pulp Capping with a Biodegradable Ceramic, J. Dent. Res., (In Press).

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL	
				DA OH 6038	76 07 01	DD-DR&E(AR)636	
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75 07 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES*	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	62110A	3A162110A825		00		117	
b. CONTRIBUTING							
c. CONTRIBUTING	CARDS 114(f)						
11. TITLE (Precede with Security Classification Code)*							
(U) Development of Endodontic Procedures for Military Dentistry							
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19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Basic Sciences			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
NAME: Cutright, D.E., COL, DC				NAME: Brady, J.M., COL, DC			
TELEPHONE: 202-576-3484				TELEPHONE: 301-677-4915			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS del Rio, C.E., COL, DC; Levin,			
(U) Endodontic Instruments; (U) Endodontic Materials;				NAME: M.P., COL, DC; Paquette, O., LTC, DC,			
(U) Silver Cones; (U) Gutta Percha; (U) Pulpal Injury.				NAME: Grower, M.F., MAJ, DC			
22. KEYWORDS (Precede EACH with Security Classification Code)							
23. (U) Army endodontic procedures in the military total 108,000 per year and are 25% of dental emergency procedures. Tooth reimplantation with endodontic therapy is involved in most serious facial injuries and involves typically 3 to 5 patient visits. The military can gain at least a 50% reduction in patient and specialist man-hours spent in endodontic therapy with the development of more rapid and reliable treatment materials and techniques.							
24. (U) Two areas to be investigated under this project are; (1) analysis of endodontic materials including those in use and newly developed; (2) techniques used in endodontic therapy with emphasis on the development of the most rapid and accurate method within the military type practice.							
25. (U) (75 07 - 76 06) An SEM study of root canal walls before and during debridement indicated that instrumentation should precede the introduction of chemicals. Vitalium is being evaluated as an endodontic material. An effective small animal model for endodontic research is being developed. An <i>in vivo</i> animal model for the mass testing of endodontic materials and reagents is being developed. A study has been completed which demonstrates the critical need for cooling during high speed cutting to prevent pulpal injury. Evidence has been obtained that histamine plays the same role in pulpal inflammation as is seen in other tissues.							

* Available to contractors upon originator's approval

PII Redacted

ENDODONTIC PROCEDURES OF IMPORTANCE TO THE ARMY

DEBRIS ELIMINATION FROM NEW AND USED FILES AND REAMERS

One prerequisite for sterilization is the complete cleaning of instruments to eliminate debris remaining on the surface of the instrument which may interfere with sterilization. The two most common methods for debriding instruments are hand scrubbing and ultrasonics. Hand scrubbing, although effective, is time consuming and effectiveness depends greatly on the motivation of the person cleaning the instruments. On the other hand the ultrasonic method is completely automated requiring little supervision.

It was our purpose in this research project to find the most effective method to clean dental endodontic instruments preoperatively, during operation, and postoperatively. This will reduce the patient-soldier's treatment time, guarantee proper sterilization of instruments and release dental assistants for other duties.

New K-files, reamers and Hedstrom files from Star, Kerr and Union Broach Manufacturing Co. (270 in total) were examined under a stereomicroscope to determine the amount of debris that was present. Examination demonstrated that new instruments have metal spurs, plastic and other types of debris on their surfaces, requiring cleansing of the instrument prior to being autoclaved.

Various methods were employed for the cleaning of instruments, for example, cotton rolls, rubber-dam, etc. On new and postoperative instruments, the most effective was 2 by 2 inch gauze wipes hand held.

RADIOGRAPHIC AND MORPHOLOGICAL CHARACTERIZATION OF GUTTA-PERCHA POINTS

Ideally, the root canal filling material should completely obliterate the root canal space. Gutta-percha is the material of choice for obturating root canals. Certain properties of commercially available gutta-percha points interfere with the goal of complete obliteration of the root canal. These include lack of standardization, inconsistent radiographic appearance, porosity and surface defects.

Ten points, size 50, of six different manufacturers were picked at random. The points were radiographed to compare the radiographic appearance and demonstrate the presence of internal voids. The diameter of the points was measured at 0.5 mm from the tip (D_1) and at 16 mm from D_1 (D_2). These diameters were compared with the prescribed diameter used in standardization of instruments.

The points were studied and photographed through the stereomicroscope to study the degree of taper, smoothness of the surface, and configuration of the tip. The weight of the points was determined by using an analytical balance and their volume determined by immersion into liquid petrolatum in 1 ml calibrated pipette. Data was collected, information is being tabulated, and the paper is being written.

The purpose of this investigation was to evaluate gutta-percha points in order to reduce the 20 to 25% failure rate and therefore reduce the time lost in retreatment of cases. This will minimize the wasted time of the soldier-patient and the dental officer.

STUDY OF INTENTIONALLY SUBMERGED ENDODONTICALLY TREATED
ROOTS FOR ALVEOLAR RIDGE RETENTION

Ridge resorption and loss of proprioceptive sense are important problems facing removable prosthesis. Concern about these problems in our military patients has stimulated research to maintain alveolar ridge height, contour, and proprioceptive sense in order to facilitate the construction of full dentures and increase the efficiency of mastication and the retention of the appliance by our patients.

The retention of root tips in the alveolar housing due to surgical accidents have shown that the alveolar ridge retains its original contour and height. Studies have tested the possibility of embedded roots in the alveolus, either vital or non-vital, to improve denture stability and function.

Amputation and contouring of the root segment in situ are very difficult, therefore the purpose of this study was to compare the embedding procedures of apical segments of roots with root canals when the shaping and contouring were done in situ with segments of roots versus shaping and contouring done after extraction and re-implanted.

Root canals were done in the root segments due to the difficulty of maintaining sterility during amputation procedures and the inability to completely cover the root by a mucoperiosteal flap.

Mandibular molars of three dogs were divided into two experimental groups. All teeth in both groups were treated with root canals. In one group the teeth were reduced in length, contoured and covered with a mucoperiosteal flap. In the other group, the teeth were extracted, contoured and re-implanted.

Histological examination of the specimens showed that the group of roots that were re-implanted showed areas of resorption. In the group of

roots done in situ the healing progressed uneventfully.

Although the reduction of roots in situ is more cumbersome, the result of the technique is more predictable and biologically acceptable.

RETENTION OF ROOTS TO PRESERVE THE ALVEOLAR PROCESS
(HUMANS)

Normally, when a tooth is extracted, the bone that was supporting the tooth resorbs. If a prosthetic appliance is to cover the area, preservation of such bone would be advantageous for appliance stability.

This project is evaluating the ability of retained roots to maintain the supporting bone. Instead of extracting all the teeth, certain key ones are retained, root canal fillings are placed and the teeth are reduced to a point that gingival tissue can totally cover them. After healing, the teeth cannot be seen clinically. A prosthetic appliance is then made to replace the missing teeth and fits over the areas where the selected retained roots are located.

Thus far two patients have been treated with the above technique. Results after three months are very encouraging. The alveolar ridges are providing good stability for the dentures and the submerged roots have not supererupted. Radiographs indicate no pathology. These patients will be continually followed. If the technique is successful, military dentists will have a method whereby they can retain supporting bone in their denture patients.

ROOT CANAL TAPER AFTER PREPARATION WITH ROTARY INSTRUMENTS

Biomechanical preparation is one of the most important aspects of root canal therapy. It has been advocated that mechanically driven instruments are more effective and less time consuming in the biomechanical instrumentation of root canals.

The purpose of this study was to describe and compare the taper of root canals prepared with various rotatory instruments to that of canals prepared with hand instruments. At the same time investigate the feasibility of replacing hand instruments by mechanically driven instruments in order to decrease treatment time for the military patient.

Fifty extracted, single canal human teeth, stored in 10% formalin were divided into five equal groups. One group served as control and the other groups were instrumented with hand instruments, Gates-Glidden drills, Peeso reamers or the Giromatic system. The teeth were sectioned bucco-lingually and photographed through the stereomicroscope after being dehydrated and coated with gold-palladium in a sputter device. From the photographs, the diameter of the root canal was measured at each 10% of the distance from the apical foramen to the cemento-enamel junction.

The results showed no significant difference in taper among the various groups. Ledging was observed in 50% of the cases instrumented with the Gates-Glidden drill and in 70% of the specimens instrumented with the Peeso reamers. No ledging was observed with the Giromatic or hand instruments. It was also noted that the Peeso reamers left areas in the canal that were not instrumented.

THE INFLAMMATORY RESPONSE OF PERIAPICAL TISSUES OF RATS TO ROOT CANAL MEDICATION

Various non-specific drugs have been recommended for intracanal medication in root canal therapy. The elimination of microorganisms in the root canal reduces inflammation and promotes healing of the periapical tissues. Many studies have attempted to determine the toxicity of root canal medications, but few of them have involved the periapical tissues. The purpose of this study was to evaluate the inflammatory effect on periapical tissues of three endodontic medications, camphorated paramonochlorophenol, metacresylacetate and formocresol.

Thirty-six rats were divided into three groups of twelve each. Root canals were performed in the mesial canal of the mandibular first molars using the left molar as control and placing one of the three medicaments through the mesial root canal of the mandibular right first molar into the periapical area.

The histologic report showed that there were no significant differences in the inflammatory responses elicited by metacresylacetate, paramonochlorophenol and formocresol. Inflammation decreased as a factor of time. The six hour group produced the greatest degree of inflammation with each of the medicaments. Instrumentation was apparently responsible for this. After 21 days, tissue had returned to normal.

THE EFFECTS OF PARTIALLY FILLED POLYETHYLENE TUBE INTRAOSSEOUS IMPLANTS ON RAT OSSEOUS TISSUE

A knowledge of the reaction of living tissues to foreign substances used in obliterating root canals is essential. Since these materials remain

permanently embedded, it is obvious that the methods used to fill an endodontically treated tooth that produced the least reaction are to be preferred. The technique of filling root canals short of the apex have produced the most successful results clinically. It has been postulated that organic matter might pool in the dead space of the root canal that is underfilled. It is the purpose of this study to investigate the reaction of osseous tissue to an underfilled polyethylene tube implant and to determine if there is any pooling of organic matter in the underfilled portion of the polyethylene tube. This will help us in determining the terminus of the root canal in military practice.

Four millimeters of polyethylene tubing of internal diameter 0.46 mm were filled flush at one end and underfilled one millimeter at the other end with gutta-percha and Grossman's cement. The filled tubes were implanted in the right tibia of forty white male rats. The left tibias were used as control by implanting 4 mm of hollow polyethylene tube.

The animals were sacrificed at 4, 7, 30 and 90 days. The histologic report showed no inflammatory "halo" effect around either the underfilled or flush end. There was no evidence of pooled organic matter either in the underfilled end or the hollow tube. It was observed in the control, that osseous tissue grew through the length of the hollow tube.

COMPARISON OF THE TISSUE RESPONSE OF A NEWLY INTRODUCED NON-EUGENOL ROOT CANAL SEALER AND GROSSMAN'S CEMENT

The irritation potential of zinc oxide and eugenol cements have been demonstrated by various studies. Most of our root canal cements are basically zinc oxide and eugenol. It has been postulated that the eugenol is the cause of the inflammatory response.

The purpose of this study was to investigate the inflammatory properties of a new endodontic cement that does not contain eugenol. If the cement has no inflammatory properties and the same physical properties as other endodontic cements, it will be beneficial for reducing the post obturation inflammation in the periapical tissues of our military patients. This will decrease the post-treatment visits.

The inflammatory potential testing was two fold; reaction to connective tissues and reaction to osseous tissues of rats. Two separate studies were performed in fifty-six rats. Polyethylene tube implants were filled with freshly mixed sealers and placed into four abdominal sites. The second study evaluated the bony response of freshly mixed sealers implanted into the tibias. All implants, in both studies, located on the animal's right side contained Grossman's cement; those on the animal's left contained the non-eugenol sealer.

The histology has been done and the results are being analyzed.

USE OF THE SCANNING ELECTRON MICROSCOPE IN MEASUREMENT OF PULP
HEALING IN TREATMENT OF CARIOUS AND NON-CARIOUS PULP EXPOSURE-
CHARACTERIZATION OF MICROSTRUCTURE OF THE NORMAL HUMAN PULP/DENTIN
INTERFACE

Repair of clinical pulp exposures requires not only reorganization of the pulpal tissue after the initial inflammatory response to a more normal connective tissue, but also mandates a repopulation of the damaged layer of odontoblastic cells beneath the site of exposure and their subsequent production of predentin and calcified dentin. The SEM accompanied by meticulous techniques of rapid specimen fracture and fixation was used to establish baseline structure, at moderate to high magnification, of all

the microanatomic structures in the dentin/pulp border.

The odontoblastic cells were vase-shaped, the enlarged basal portion of the cell body contained the cell nucleus. The odontoblastic process extended well beyond the predentin/dentin border, but did not contain organelles. Intra-process needle like deposits were observed with the TEM, and will be examined with the STEM probe module for evidence of intracellular calcification. The most notable results were seen in SEM examination. Intercellular collagen fibers were observed to extend between the pulp and predentin to blend with the circumtubular collagen of the predentin. These fibers were identified as collagenous by means of their 600 A banded substructure. These fibers, in areas of pulp-dentin separation, remain stretched but intact and are the means of attachment of the underlying pulp connective tissue to the dentin wall. This is the first reported description of these fibers, and these fibers appear essential for normal pulp organization.

Calcification at the dentin border was universally proceeding along a semilunar front around 5-10 odontoblastic processes, suggesting a multi-cellular mechanism of calcification involving 5-10 odontoblasts, or a less-likely possibility that the cell processes in these areas are branches from one cell body.

SCANNING ELECTRON MICROSCOPY EVALUATION OF DENTAL IMPLANT RESPONSE: DEVELOPMENT OF EVALUATION TECHNIQUES

Scanning and light microscopy characterization of two critical areas of dental implants are being performed, the collagenous bone, implant union and the epithelial and subepithelial attachment. At this time no implant material is available that provides a surface for collagenous

union, which is critical for retention and function. SEM studies on human and rodent bone indicate two types of bone surfaces - defined here as functional and non-functional. Non-functional bone such as that beneath long bone periosteum, or lining haversian canals and marrow cavities was observed in the SEM to be smooth, with just-visible subsurface collagen bundles parallel with the surface. Functional bone such as at sites of ligament attachment and the bone surface of the periodontal ligament space was observed in the SEM, after perchlorate digestion to be covered with small dome shaped masses, representing calcification fronts proceeding along collagen bundles perpendicular to the bone surface.

Epithelial attachment to cementum in the SEM was by means of 2 structures, the outermost cell of the gingival sulcular epithelium and a newly-discovered subepithelial collagenous network that extends between the basal layer of epithelium next to the tooth to the first fibers of the transeptal group - a distance of 106 microns as measured in a series of 11 rodent molars.

The ease with which these structures can be observed with the scanning microscope will lead to a more critical analysis of dental implant acceptance, and ultimately to design of dental implants that are fully accepted by the host tissue in full function.

EFFECTS OF INSTRUMENTATION WITH A CHELATING AGENT ON THE PERIAPICAL SEAL OF OBTURATED ROOT CANALS

The effects of a mixture of EDTA, urea peroxide, and carbo wax used in instrumentation of the root canals of extracted teeth prior to sealing of the canals with silver points or gutta-percha were compared to instrumentation with sodium hypochlorite alone. It was found that instru-

mentation of the teeth with the EDTA mixture prior to sealing the canals caused a 2-fold increase in leakage when measured by the uptake of radioactive iodine. It was also found that teeth filled with silver points were 11-13 times more leaky than those filled with gutta-percha.

EFFECTS OF SOLUTIONS USED TO TREAT DENTAL FLUOROSIS ON TOOTH PERMEABILITY

Dental fluorosis and tetracycline staining frequently result in teeth which are unsightly to the patient and his peers. As a result much effort has been expended by clinicians to cosmetically treat these conditions.

McInnes' technique is the most widely used today. The bleaching solution consists of five parts 30% H_2O_2 (1cc), five parts 36% HCl (1cc), and one part ethyl ether (0.2cc).

Although McInnes' technique is widely used no studies have reported the degree of penetration this solution has through intact enamel and dentin. The purpose of the first part of this study was to evaluate the penetration of saline, H_2O_2 , HCl and ethyl ether, which were labeled with a tracer of radioactive P^{32} , through the enamel and dentin of freshly extracted teeth into the pulp chamber. The second part of the study evaluated the effects that the treatments had on the permeability of the enamel and dentin of the treated areas. This was done by soaking the treated teeth in saline labeled with I^{125} overnight and measuring the total uptake of I^{125} by gamma counting.

Results indicated that none of the solutions tested penetrated to the pulp chambers of test teeth to any significant degree. Also, the

permeability of dentin and enamel did not appear to increase. It was concluded that McInnes' solution can be safely used to bleach discolored teeth rather than the use of full crowns which are considerably more expensive in both professional man-hours and materials.

AN ELECTRICALLY HEATED INSTRUMENT HOLDER FOR USE IN TOOTH BLEACHING
AND ENDODONTICS AND FOR GENERAL UTILITY IN FIELD AND CLINICAL DENTISTRY

Many procedures in dentistry must be, or are best done with heated instruments. The usual procedure is to carefully heat an instrument over an open flame and trust that it will be clean and at the proper temperature when it reaches the operating site. This is a cumbersome, inexact procedure, often involving the mutilation of quality instruments which must then be replaced. Development of a convenient, electrically heated holder capable of accommodating a wide assortment of operating tips would enable the dental officer to function precisely, efficiently and economically, with no need to damage instruments needed elsewhere. This is especially advantageous in field practice, where strained circumstances and minimal available time and materiel demand economy in both function and instrumentation.

A pilot prototype using the components of a miniature, pen-sized soldering iron has been assembled but requires additional refinement in both design and fabrication to suitably broaden its applicability and improve its reliability. Work continues.

SPECIAL ENDODONTIC INSTRUMENTS FOR MORE EFFECTIVE AND CONSERVATIVE INSTRUMENTATION OF INTERNALLY RESORBED PULP CANALS

Internal resorption in dental root canals often produces locally expanded lesions that are difficult if not impossible to instrumentate through a root canal of normal diameter. While some enlargement of the canal is acceptable in these cases, minimal enlargement is desirable so as to conserve insofar as possible the mechanical strength of the remaining root structure. Gates-Glidden burs have been pressed into service, but the poorly shaped heads, excessively fine blades, and too flexible shanks render them generally unsuitable. Conventional carbide burs for the straight handpiece, with appropriately altered shanks have promise of filling all requirements. Several such burs, of different sizes, have been modified and are awaiting clinical trial. These instruments should be relatively inexpensive and small enough to be easily incorporated in a combat dental operating kit of the kind now being considered for military field use.

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6. Cooke, H.G., Grower, M.F. and del Rio, C.E.: Effects of Instrumentation with a Chelating Agent on the Periapical Seal of Obturated Root Canals, J. of Endodontics, (In Press).
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8. Griffin, R.E., Grower, M.F. and Ayer, W.A.: Effects of Solutions Used to Treat Dental Fluorosis on Tooth Permeability, J. of Endo, (In Press).
9. Hand, R.E., Huget, E.F. and Tsaknis, P.G.: Effects of a Warm Gutta-Percha Technique on the Lateral Periodontium, Oral Surg., (In Press).

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL DD-DR&E(AR)636	
3. DATE PREV. SUMMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING	8a. DISB'N INST'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
75 07 01	D. CHANGE	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. NO./CODES*	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	62110A	3A161110A825		00		122	
b. CONTRIBUTING							
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11. TITLE (Precede with Security Classification Code)* (U) Biodegradable Materials for the Treatment of Fractures and Soft Tissue Wounds in the Military Situation							
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003500 Clinical Medicine							
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68 01		CONT		DA		C. IN-HOUSE	
17. CONTRACT/GRANT				18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	
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b. NUMBER:*				FISCAL YEAR		76	
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d. AMOUNT:				77		11.2	
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19. RESPONSIBLE DOD ORGANIZATION				20. PERFORMING ORGANIZATION			
NAME: US Army Institute of Dental Research				NAME: US Army Institute of Dental Research			
ADDRESS: Washington, D.C. 20012				Division of Surgery			
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NAME: Cutright, D.E., COL, DC				PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)			
TELEPHONE: 202-576-3484				NAME: Cutright, D.E., COL, DC			
21. GENERAL USE				TELEPHONE: 202-576-3484			
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22. KEYWORDS (Precede EACH with Security Classification Code)				ASSOCIATE INVESTIGATORS			
(U) Oral Antral Fistula; (U) Polylactic Acid; (U) Biodegradable Polymers; (U) Polyglycolic Acid; (U) Tricalcium Phosphate.				NAME: Nelson, J.F., LTC, DC			
23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)							
23. (U) To determine the best usage of biodegradable copolymer materials for the treatment of both hard and soft tissue wounds. To develop premedicated biodegradable tissue fixation devices. To determine feasibility of a long-term, subcutaneous, slow release drug delivery systems.							
24. (U) The recent adaptation by USAIDR of the biodegradable copolymers to the surgical procedures such as tendon gliding devices, oral antral fistula closure and peripheral nerve repair will be expanded in animals and extended to man. Application to the Drug Review Board has been made for this usage.							
25. (U) (75 07 - 76 06) Histologic evaluation of oral antral fistulae in monkeys repaired with PLA and PGA copolymer sheets has been completed and the results bear out gross observations that good healing and complete closure takes place within 63 days. The procedure does not produce the surgical trauma or require the exacting technique associated with the plastic flap approach. A study in rats has demonstrated the feasibility of using PGA cylinders to induce the formation of autogenous hollow organ grafts. A study is in progress in which tricalcium phosphate and PLA are being compared as osteogenic agents.							

* Available to contractors upon originator's approval.

PII Redacted

BIODEGRADABLE MATERIALS FOR USE IN TREATMENT
OF FRACTURES AND WOUND CLOSURES

REPAIR OF ORAL ANTRAL FISTULAE BY A BIODEGRADABLE COPOLYMER OF
POLYLACTIC (PLA) AND POLYGLYCOLIC ACID (PGA)

Tissue reaction of polylactic and polyglycolic acid is minimal and when degraded these materials are replaced by fibrous connective tissue and/or bone with subsequent closure of the fistula.

Artificially created oral antral fistulas were created and repaired using PLA and PGA copolymer sheets at the level of the sinus floor of monkeys. Microscopic evaluation following animal sacrifice at periods, of 14, 28, 42, 49, 56, and 63 days revealed no adverse response by the exposed tissues to the PLA/PGA copolymer. Complete epithelization occurred at 28 days following a vigorous proliferation of fibroblast-collagen-capillary network which provided a base for re-epithelization. Osseous bridging was noted to take place at 42 days with complete microscopic closure of the defect occurring at the end of 63 days. This procedure does not produce the surgical trauma or require the exacting technique associated with the widely used plastic flap approach. By employing the biodegradable PLA/PGA material the necessary removal of the gold foil plate associated with that form of obturation is eliminated. The results of this work demonstrate that combat wounds involving the loss of palatal bone can be repaired in a one step procedure with considerably less trauma and therefore improved chances of uneventful and more rapid recovery.

THE USE OF POLYGLYCOLIC ACID CYLINDERS TO INDUCE THE FORMATION OF AUTOGENOUS HOLLOW ORGAN GRAFTS

This experiment has shown the feasibility of forming hollow organs by utilizing biodegradable copolymer mandrils.

Twelve rats received 24 biodegradable mandrils in the subcutaneous tissue of the belly. These areas were harvested at 15, 30, 45 and 60 days.

Slides prepared from these tissues showed the formation of hollow tissue tubes with connective tissue walls 0.2 mm to 0.3 mm thick. The tissue reaction of the biodegradable copolymer was minimal and consisted primarily of mononuclear cells. The copolymer degraded slowly and disappeared completely between the 45th and 60th day.

Experiments to determine the feasibility of using these performed tubes for blood vessels, salivary gland ducts and ureteral replacements are being planned.

The success of this technique would markedly enhance the ability to treat combat type injuries affecting hollow organs of the body.

EVALUATION AND COMPARISON OF TRICALCIUM PHOSPHATE AND POLYLACTIC ACID AS OSTEOGENIC AGENTS

Studies have shown that polylactic and tricalcium phosphate are non-toxic and non-tissue reactive when implanted in laboratory animals. The purpose of the present study was to determine the comparative effectiveness of PLA and tricalcium phosphate in bone regeneration and to show the compatibility of the two substances used together as a lattice-work for bone regeneration in bone defects. The rat tibia model is being used and animals are being sacrificed at the 14, 28 and 42 day time inter-

vals. Four categories are designated; one composed of PLA, one of tricalcium phosphate, one of a combination and the controls. Final animal sacrifice is due shortly.

PUBLICATIONS

1. Miller, R.A., Brady, J.M. and Cutright, D.E.: Degradation Rates of Oral Resorbable Implants (Polylactates and Polyglycolates). Rate Modification with Changes in PLA/PGA Copolymer Ratios, J. Biomedical Res., (In Press).
2. Jordi, H.C., Grower, M.F. and Cutright, D.E.: The Use of Biodegradable Polymers for Slow Drug Release, J. Dent. Res. (Spec. Issue) 55 B #1067, (1976).
3. Miller, R.A., Cutright, D.E. and Brady, J.M.: Degradation Rates of Oral Resorbable Implants, J. Dent. Res. (Spec. Issue) 55 B #291, (1976).

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